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Evaluating the Effectiveness of Offsets as a Mechanism for Promoting Malaysian Defence Industrial and Technological Development

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"This thesis is submitted in partial fulfilment of the requirement for the Degree of PhD"

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ABSTRACT

Offsets have taken centre stage in defence trade. To date, more than 78 countries around the world practice offsets and outstanding offsets obligations run into billions of US dollars However, why have offsets gained such a momentum? Increasingly, both sellers and buyers in the arms trade view offsets as an efficient and effective economic compensation tool to justify arms deals. Buyers, consider offsets as a catalyst for industrial and technological development, employment, creation of value-added activities and skills development. Sellers, on the other hand, perceive offsets as providing product differentiation and competitive advantage in an already tough defence market. The question, though is whether, do offsets really work as claimed? The purpose of this dissertation is to empirically verify the above proposition by evaluating the effectiveness of defence offsets in developing a defence industrial and technological base, using Malaysia's defence industry as a case study.

This study employs a Multi-Method or Triangulation Methodological approach (comprising survey, archival sources and participatory observation) to gather data. Fieldwork research employing questionnaires and interviews were undertaken as part of a survey of Malaysian defence companies, international defence contractors and relevant offsets-related government and non-governmental agencies. These data were further substantiated and consolidated via archival sources, such as government and company reports and also participatory observation.

Research analysis indicates that offsets have provided mixed results, in the case of Malaysia. The successes have been mainly focused on technology capability-building and human resource development, limited to through-life-support of the defence equipment and the ancillary systems purchased. Morover, offsets have been successfully used to diversify into civil sectors, mainly aerospace and electronics sectors, leading to increased exports, jobs, backward linkages and technology enhancement in these sectors. However, offsets have had minimal effect on creating joint-production, collaborative activities and R&D programmes, requisites for the process of *Malaysianisation.* Further, offsets have also been less than effective in

increasing employment, and dual-use technology programmes that could provide long-term impact on Malaysia's economic growth.

Overall, Malaysia's offsets policy has been pragmatic and flexible. The government has played a vital role in ensuring that the offsets policy operates in tandem with Malaysia's national aspirations. Yet, offsets have had a limited impact on developing and sustaining Malaysia's defence industrial and technology base. The offsets policy aim and objectives have not been clearly reflected in the offsets process and implementation. As defence offsets will continue to be of an essence in Malaysia's defence procurement activity, initiatives should be taken to review the offsets policy and implementation processes. The review should augment the effectiveness of offsets in developing measurable and value-added programmes that build a sustainable and competitive Malaysian defence industry. To this end, and based on the research findings of this study, a number of important policy recommendations are advanced to raise the effectiveness of Malaysia's offsets policy.

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Abbreviations

ACA	American Countertrade Association
AFH	Armed Forces Headquarters
APCA	Asia Pacific Countertrade Association
ASEAN	Association of South East Asian Nations
BOT	Build, Operate and Transfer
CTO	Countertrade and Offsets
DESO	Defence Export Services Organisation
DIBP	Defence Industrial Blue Print
DID	Defence Industry Division
DMA	Defence Manufacturers Association
DSTP	Defence Science and Technology Policy
EOI	Export Oriented Industrialisation
EPU	Economic Planning Unit
FDI	Foreign Direct Investment
FPDA	Five Power Defence Arrangement
ICT	Information Communication and Technology
ILS	Integrated Logistics System
IMF	International Monetary Fund
IRPA	Intensification of Research in Priority Areas
ISI	Import Substitution Industrialisation
ISIC	International Standard for Industrial Classification
JV	Joint Venture
LSG	Linear Stages of Growth
MAF	Malaysian Armed Forces
MDIC	Malaysian Defence Industry Council
MDIS	Malaysian Defence Industrial Strategy
MDTS	Malaysian Defence Technology Strategy
MIDA	Malaysian Development Industrial Authority
MIDA	Malaysian Industrial Development Authority
MIGHT	Malaysian Group for High Technology
MINDEF	Ministry of Defence
MITI	Ministry of International Trade and Industry
MNC	Multinational Corporation
MNDU	Malaysian National Defence University
MOD	Ministry of Defence
MOF	Ministry of Finance
MRO	Maintenance, Repair and Overhaul
NDPC	National Defence Production Committee
NIC	Newly Industrialised Countries
NIS	National Innovation System
OECD	Organisation for Economic Corporation and Development
OEM	Original Equipment Manufacturer
PDC	Potential Defence Capacity
PSCNDSB	PSC Naval Dockyard Sdn Bhd
R&D	Research and Development
RMA	Revolution in Military Affairs

SME	Small and Medium Enterprises
STRIDE	Science, Technology and Research Institute for Defence
TCB	Technology Capability Building
TDA	Technology Depository Agency
TOT	Transfer of Technology
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nation Industrial Development Organisation
ZOPFAN	Zone of Peace, Freedom and Neutrality

Chapter 1

1. INTRODUCTION

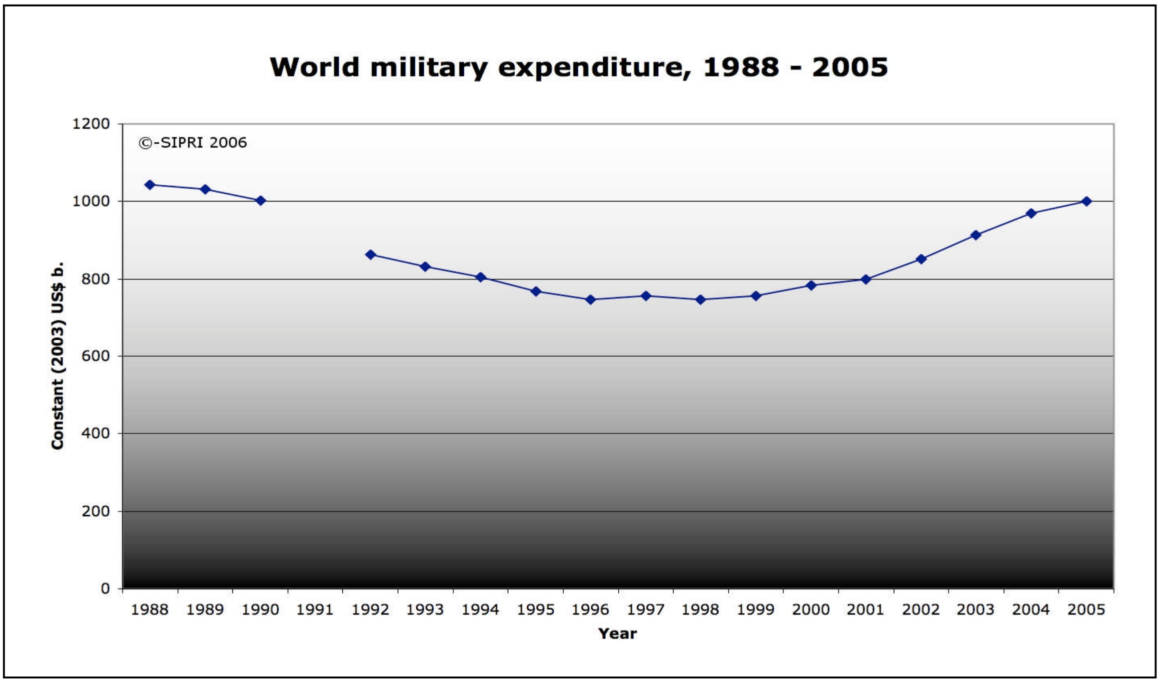
1.1 The Rise of Offsets

Traditional arms trade deals have been transformed into professionally managed economic transactions. At the core of this process, lie offsets; an economic compensation package that has become a permanent feature of international business. Today, offsets are an inherent feature of the global procurement system. Often, negotiations to get the best offsets deals eclipse the focus on the technical aspects of arms procurement. Offsets, however, are not without criticism and suspicion. While the proponents of offsets argue that they create economically viable and strategically relevant growth, the opponents, on the other hand, believe offsets create distortions.[1] Yet, the subjectivity, non-transparency and relevance of offsets make a systematic attempt to study the subject irresistible and challenging. This unique trading mechanism has gained prominence in the area of development economics, triggering research activity among practitioners and scholars of the development community.

Why have offsets gained such attention and publicity in the past two decades? The reasons are several. First, there was a massive reduction in world wide defence budgets since the early 1990s. Figure 1.1 illustrates the falls in world military expenditure since 1988.[2] The reductions were mainly due to the re-prioritisation of military expenditure following the perception of a benign security environment after the disintegration of Soviet Union. Governments were mainly interested in upgrading systems rather than purchasing new weapon systems. Since 2000, there have been increases in defence spending mainly reflecting the surge in the US defence spending, responsible for almost 80% of the increase in 2005. This sudden increase is attributable to the aftermath of 9/11 to combat terrorism and the costly military spending in Afghanistan and Iraq. The overall reduction in defence spending has turned the market into a buyers' market, encouraging buyers to seek greater value for money in the form of offsets. The buyers' hard-nosed tactics have placed defence contractors under tremendous pressure to provide state-of-the-art defence equipment as well as granting other accompanying benefits.

Second, the reduction in defence budgets has created aggressive arms exporting policies to offset the loss of domestic development and production.[3] Defence contractors which had multiplied in numbers during the Cold War, were now out of business due to the lack of demand for newer equipment. Defence companies, especially from the Eastern bloc, began to suffer from serious debt. There were increasing pressures to keep the defence industry alive as well as sustain jobs. Besides restructuring, mergers, consolidation and rationalisation, defence contractors were also forced to introduce more innovative strategies such as offsets in an increasingly competitive business environment.

Figure 1.1: World Military Expenditure, 1988-2005



Source: Stockholm International Peace Research Institute (SIPRI), *World Military Expenditure, 1988-2005*, [online], (SIPRI, Stockholm, 2006), (Accessed: 11 March 2007), Avialable via: http://web.sipri.org.

Third, the global defence industry was further challenged by changes emanating from the revolution in military affairs or transformational warfare.[4] Diminishing defence budgets, rising weapons costs, downsizing and the consolidation in defence industries led defence ministries and military organisations around the world to upgrade existing systems. The change process has been towards leaner forces, with greater specialisation, emphasising computer-driven developments in sensors, information processing, communications, control and precision weapons, at the technological heart of the RMA.[5] This has caused great financial strain on defence contractors to increase investment into research and development, thus further escalating equipment costs. Defence suppliers have had to create product differentiation by introducing offsets to gain competitive advantage in the defence industry market.

Finally, the shift in international political economy towards globalisation and liberalisation has forced many nations to rethink national development goals. Government priorities were directed towards other sectors of development, such as health, education and social welfare due to the limited financial resources. Nations continued to suffer from the barriers to defence trade, not least because the arms trade is not covered under the WTO[6] free trade regulations. Newer challenges, such as restrictive government policies on arms exports and comprehensive rules for the sharing of sensitive technologies, especially by the United States (US) further restricted the arms market. For politicians, offsets were seductive, as they could be partially used to justify military purchases.[7]

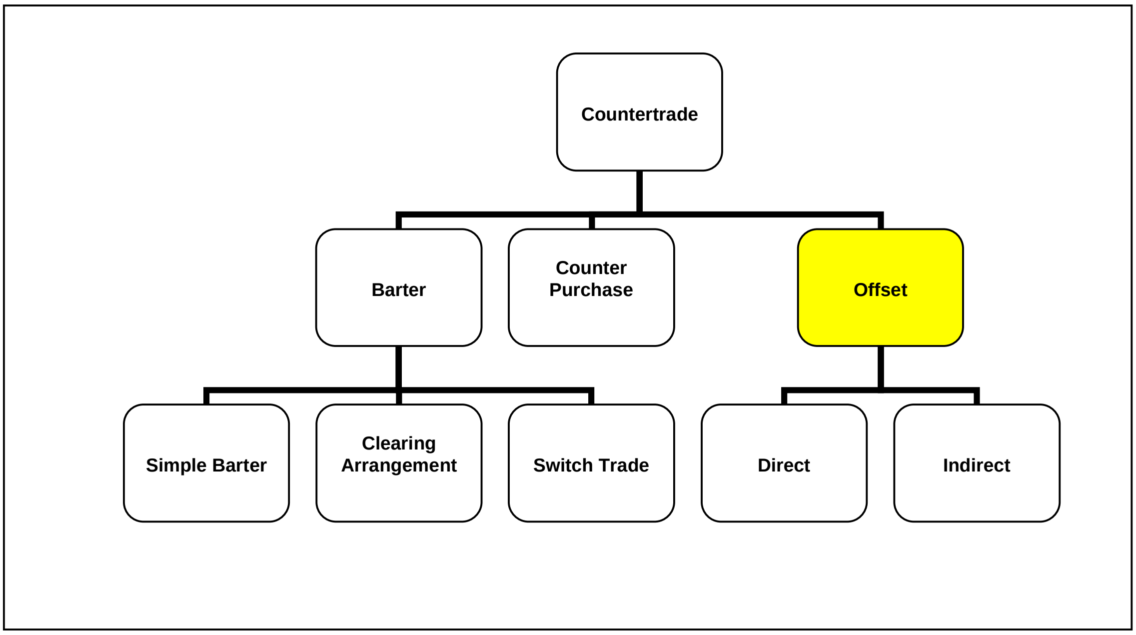
World transactions involving offset deals amounted to billions of dollars, with most offsets transactions occurring in the developed countries, mainly within Europe. From 1993-2005, US prime contractors alone entered into 538 offset agreements totalling USD 56.6 billion or 71.2% of export contract value compared with total defence exports of USD 79.5billion.[8] From this data, 286 offset agreements were signed with European countries, totalling $36.8 billion offsets value.[9] By comparison, US defence contractors signed 252 offsets agreements with Non-European countries totalling $19.8 billion worth of offsets value.[10] Overall, from 1993-2005, the UK has the highest offsets obligations amounting to $3.9 billion (17.8%) of the total offsets value, followed by Republic of Korea with 59 offsets agreements worth $5.2 billion and Taiwan with 39 offsets agreements worth $2.2 billion.[11] Generally, Middle Eastern countries and most countries in the Pacific areas with equally large export contract values demand lower offsets than European countries. Of the 252 offsets agreements with non-EU countries, 169 (68.5%) had offsets percentages of 50% or more but less than 100%.[12] Only 15.5% have offsets requirements in excess of 100% or more.[13] Many other offset deals around the globe are unaccounted for, not classified, or simply not documented, due to the sensitivity of defence procurement.

1.2 Definition

Following this introductory scoping of the role of offsets, it is now necessary to define the subject. The problem is that offsets mean different things to different people. There is neither one specific terminology nor one definition of offsets. Each country labels offsets differently. Figure 1.2 explains offsets as a subcomponent of countertrade. Offsets are also known as Industrial Participation, Economic Enhancement, Compensation Packages, Industrial Benefit Programmes and Countertrade Policy. Generally, offsets are defined as an arrangement between a national government and a foreign arms supplier to direct some benefits of the contract back into the purchasing country as a condition of sale.[14] Offsets comprise an entire range of industrial and commercial compensation practices, plus inducements or conditions for the purchase of military goods and services. These include co-production, joint venture, buy-back, knowledge transfer, training, and investment, marketing assistance and counter-purchase. Offsets can be direct or indirect but other elements such as counter-purchase and structured finance have taken prominence of late. Developed countries normally limit offsets to technology transfer. In contrast, in developing countries, offsets cover a wider scope, including barter, counter-purchase and structured finance. Controversy persists about including basic training and periodic maintenance during the warranty period as part of an offsets deal. These definitions, suggest that offsets are mainly used to improve and further enhance economic development.

This study will not include counter-purchase (purchase of commodities or finished goods from the buyer country's existing supplier base), nor will it include structured finance in developing countries. Both are perhaps questionable in their effectiveness, but they have no direct bearing on industrial and technological development.

Figure 1.2: The Reciprocatory Trade Framework



Source: Johan Van Dyk, Denel Pty Ltd, South Africa, Introduction to Offsets, *In: 02 Countertrade Conference, Civil Service Golf Club, Kuala Lumpur, June 2001,* (Ministry of Defence, Malaysia, 2001).

The complexities of offsets make them a challenging and innovative tool in international arms trade. Offsets raise many issues involving the effects of policy, the guidelines, objectives and goals, as well as processes and implementation. Many countries are still struggling with the implementation of offsets. Questions are often raised as to whether there is a '*one size fits all*' formula that can be modelled to implement offsets. Countries are still confused about offset objectives and have reviewed their offsets policy objectives and goals several times.[15] Questions also abound regarding the effectiveness of offsets as a facilitating mechanism towards industrial and technological development.

1.3 Offsets: Opposing Schools of Thought

Developed and developing countries seek offsets for political, economic, industrial, trade, technology, and military reasons. Around 78 countries around the world practice offsets.[16] There are two competing schools of thought on the impact of offsets. The first views offsets as a facilitating mechanism towards industrial and technological development; the latter views them as inefficient and costly.

1.3.1 Pro-Offsets

The pro-offsets school of thought argues that offsets have generally benefited purchasing countries in terms of creating an indigenous defence industrial base, advancing technology development, increasing defence–civil integration, expanding job creation, promoting exports, enhancing human resource development and generating high-value added backward linkages. However, for developing countries with smaller defence industrial bases, offsets have been maximised for indirect purposes mainly for spin-offs into civil sectors. Offsets have also, arguably, created ‘value-added’ manufacturing jobs in the backward supply chain, providing home-grown industry with the opportunity to enhance competitiveness though collaboration and joint ventures with supplier companies.[17]

1.3.1 Anti-Offsets

The anti-offsets school of thought views offsets as ‘economically inefficient’ and market distorting.’[18] They create a financial burden to buyer countries by adding an extra ‘hidden cost’ thus further escalating defence equipment costs. The US Department of Commerce, for example, claims that offsets are discriminatory, trade distorting and against the interests of free trade.[19] Two major studies undertaken to evaluate the impact of offsets have resulted in negative conclusions. In the first of these studies, the US government evaluated the impact of offsets on the US economy and its industrial base, especially from the outflow of offsetting investment.[20] The study claimed that US subcontracting jobs and crucial technologies were lost due to the use of offsets in foreign defence sales.[21] A second study by York University on the UK Industrial Participation Policy, specifically its impact on the UK economy, was also negative about the impact of offsets.[22]

Recently, this negativism has found expression in policy statements. For instance, the US National Defence Authorisation Bill 2005 proposed that offsets be outlawed, or at the very least curtailed. For example, evidence from the US defence industry indicates that 469,000 jobs were lost as a result of offsets in the past 20 years.[23] The US Defence Department argues that weapon sales due to offsets sustained more than 40,000 U.S jobs a year whilst only creating about 9,700 jobs overseas.[24] This could be due to the highly competitive and complex nature of defence technology. The massive decline in US defence-related jobs is arguably due to the 1990's major consolidation and restructuring of the US defence industry. Notwithstanding such development, the jury is still out as to whether offsets are a positive or negative force.

1.4 Offsets in Emerging Economies

Offsets have grown in popularity and are viewed by developing countries as a 'third way', for technology acquisition and development.[25] Offsets have the potential for impacting on defence industrialisation, value creation through inter-industry linkages, economic diversification, human resource development and product and process localisation. The Newly Industrialised Group of Countries (NICs), including South Korea, Singapore and Taiwan have displayed their ability to absorb new technology and catch-up with developed countries. The developing countries have pursued roughly similar paths of economic and industrial development, involving large-scale State investments, technology imports, applied research and synergistic civil-military links.[26] Yet, for these countries, the government has had a 'visible hand' in decision-making, ensuring that successful technology transfer took place.[27] Technology transfer initiatives to these countries were mostly through foreign direct investment, joint ventures, collaboration as well as offsets.

Efforts have been directed by many nations to position offsets at the core of defence industrialisation. There is an increasing recognition that defence technologies should be spun-off into the civil industries. Whilst suppliers have been reluctant to invest in high tech plants, countries such as South Africa and South Korea have tried to create supply chains through backward linkages into manufacturing industries. They have pursued defence indigenisation to maintain national sovereignty and territorial integrity. For instance, Japan aggressively pursued indigenous defence production or 'kokusanka' via this method.[28] South Korea and Taiwan have also been heavily involved in defence industrialisation, aimed at achieving autarky in arms production as part of their defence policy and industrial objectives.[29] Today, these countries have reached a higher level of industrial capability as opposed to many of the other developing nations.

South Africa has also pursued defence industrialisation through its Defence Industrial Participation Policy. Denel (Pty) Ltd, a leading South African defence company, successfully built the tail sections of RAF Hawk fighter trainers, landing gear fuselage sections for Gripen jet fighters, rudders and ailerons for BAE Systems aeroplanes.[30] It was claimed that R104 billion worth of industrial participation commitments in South Africa would create approximately 65,000 jobs.[31] Countries such as Singapore and Indonesia have taken the middle road as their defence industries are not as large scale as those of South Korea and Taiwan but are, nevertheless, wide ranging.[32] However, others like Malaysia see offsets as a major thrust for economic development and technology acquisition with a specific focus on defence technology spin-offs, skills development and the creation of backward linkages.[33] Malaysia is also seeking defence industrialisation through offsets, in similarity to both South Africa and the other NICs. The question remains, though, whether Malaysia's offsets objectives have been achieved?

1.5 Research Problem

This study will focus on the effectiveness of offsets with a particular reference to Malaysia. There are a number of strong reasons for undertaking this research. Firstly, offsets are a relatively new trading tool in Malaysia, though other forms of countertrade such as barter have long been in existence. Malaysia's offsets policy, published in May 2006, has been constantly employed in all major defence procurements costing above Euro 50,000 since 1990.[34] Despite the huge value of transactions involved in Malaysia's offsets business, such as the Jernas short range missile from the UK , SUKHOI 30 from Russia, the PT-91 Main Battle Tank from Poland, the M5-gun from South Africa, and others, this subject has received very little academic attention. Offsets requirements were formally introduced to Malaysia in 1992 with the purchase of the Hawk aircraft from the United Kingdom.

Since 1992, offsets have featured as an essential ingredient in all major capital defence purchases. In the past 11 years (1995-2006), Malaysia has spent around RM 100 million on procurement of new weapons as well as upgrading old ones.[35] This approach sought to modernise the Armed Forces, eliminating some of the old and obsolete hardware of the post cold war era. At the same time, Malaysia has sought to keep abreast of advancements in global military technology. There was a need for modern equipment with greater firepower and mobility as well as a concentration on C4I technologies, electronic warfare and digitised soldiers with the ability to handle state-of-the-art technologies.

Malaysia's military expenditure for the period 1988-2003 is shown in Table 1.1. Expenditure increased from 1989 onwards and only started to decline in 1997 due to the Asian Financial crisis, but soared again in 2001 when the economy recovered. Most capital purchases were undertaken in the years 2001 and 2002. A list of Malaysia's defence procurements are shown at **Appendix A.** Offsets obtained through these purchases were mainly channelled towards the creation of a defence industry base, and the promotion of backward linkages, employment, skill development in high technology areas, marketing support, inward investments and counter-purchase. Malaysia's offset beneficiaries have been mainly from the Armed Forces, government agencies, defence industry, civil industry, research think-tanks and universities.

The second reason for researching offsets is to respond to serious questions regarding their short and long term impacts on Malaysia's economy. Although it is claimed that offsets do not cost money,[36] it is obvious that transaction costs have to be factored into the overall cost of equipments.[37] Issues of this nature have been constantly debated, but there are no empirical data to justify the seriousness of transaction costs. The proposed research will evaluate the impact of offsets on Malaysia's defence industrial and technological development leading to capability development, employment, human resource development, exports, industry competitiveness, sustainability of leading edge supply chain management networks, industrial diversity, R& D capabilities, intellectual property rights, patenting issues and design expertise.

Table 1.1: Malaysia's Military Expenditure in US$ and as a Percentage of GDP

Year	USD(millions)	% of GDP
1988	882	2.4
1989	1057	2.6
1990	1135	2.6
1991	1545	3.2
1992	1535	3.0
1993	1631	2.9
1994	1768	2.8
1995	1879	2.8
1996	1807	2.4
1997	1698	2.1
1998	1248	1.6
1999	1689	2.1
2000	1533	1.7
2001	1991	2.2
2002	2263	2.4
2003	2882	2.8
2004	2073	NA
2005	2363	NA

Source: Stockholm International Peace Research Institute (SIPRI). *Military Expenditure Database*, [online], (SIPRI, Stockholm, 2004), (Accessed: 11 June 2004), Avialable via: http://web.sipri.org.

Thirdly, Malaysia has allocated its offsets credits mainly to the defence sector with the objective of creating a self-reliant defence industry. The aim is for Malaysia's defence industry to progress from initial support capabilities towards more ambitious design, manufacture and production activities. However, despite support through offsets and government contracts, the Malaysian defence industry has not really taken off. It is still highly dependent on the government due to limited resources and industrial capabilities. It is thus timely to evaluate whether the defence industry has really benefited from offsets projects.

Fourthly, offsets form part of Malaysia's overall national development policy in tandem with other government policies such as Procurement, Defence, Science and Technology, the Industrial Master Plan, Five-Year Plans and Vision 2020. However, in reality, offsets do not feature clearly in any of these documents. There is a need to explore the overall offsets process and strategy to establish how it fits into the national development strategy. [38]

The fifth reason for studying offsets has regard to the important role that government plays in the offsets process. The Defence Industry Division within the Ministry of Defence was formed to oversee successful monitoring and implementation of offsets policy. This organisation works closely with all other offsets organisations within and without the country. However, most of the planning, negotiation and implementation work is done on an *ad-hoc* basis. Invariably, offsets do not feature in the procurement process until later. Malaysia's economic development objectives are clearly stated in the codified offsets policy, but the true intentions of these objectives are not reflected clearly in Malaysia's offsets implementation process. Further, the offsets policy itself does not seem to have incorporated adequate incentives that could invite high value-added offsets programmes into Malaysia. There is thus a need to review the overall offsets policy as well as the processes to address these issues.

Sixthly, the uniqueness of offsets requires that a strategic partnership between various parties, including Government, sellers, suppliers, buyers, local firms and third parties, be established to ensure a 'win-win' set of outcomes. This calls for analysis to evaluate the role, capability and commitment of these parties in ensuring the effectiveness of offsets in the long term.

1.5.1 Study Aim

The aim of this study is evaluate the 'effectiveness' of defence offsets as a facilitating mechanism for the industrial and technological development of Malaysia's defence industry.

1.5.2 Study Objectives

This study's enabling objectives are to:

i. Illustrate and evaluate the various offset models, frameworks, tools, processes and mechanisms by cross reference to offset practices in other selected developed and developing countries.
ii. Determine the factors that contribute towards an 'effective' offsets strategy.
iii. Discuss the development of Malaysia's defence industry performance and challenges.
iv. Critically analyse Malaysia's current national offset policy, processes, problems and strategies.
v. Assess the effectiveness of offsets as a tool for technological and industrial development in Malaysia's defence industry.
vi. Measure the impact of offsets on Malaysia's defence industries.
vii. Evaluate industrial and technological progress achieved through offsets-induced technology transfer.
viii. Propose policy recommendations towards an effective offsets model, enabling offsets to play a more robust role in meeting Malaysia's industrial and technological development needs.

1.6 Study Value:

The literature is replete with writings on industrial and technological development, but little of these writings focus on evaluating the impact of offsets. Stephen Martin published a volume of papers on defence offsets in 1996 by Harwood Academic Publishers (now Routledge) and eight years later in 2004, Brauer Jurgen and Dunne Paul J, published another collection of papers on offsets entitled, *Arms Trade and Economic Development: Theory, Policy and Cases in Arms Trade Offsets* by Routledge. The newer collection was basically an update of the changes taking place in the international environment and was mostly written by contributors to Martin's earlier publication. Keith Hartley had undertaken an empirical study evaluating the impact of offsets on the UK's defence industrial base and Ron Matthews had similarly evaluated the impact of offsets in Saudi Arabia. However, both of these researches had an academic slant and were not policy-oriented research papers.

Additionally, organisations such as the American Countertrade Association (ACA), Defence Manufacturers Association (DMA), Asia Pacific Countertrade Association (APCA) and SMI run periodic conferences on offsets. Presentations by government representatives, industry members and academicians at these conferences have become important reference materials to evaluate the impact of offsets. However, these papers are commercially biased. EPICOS, a Greek company, does provide a range of current information on offsets and procurement-related materials on its website. However, the site does not provide substantial statistical or empirical evidence to substantiate the impact of offsets on individual countries.[39] Most of the papers written on this topic have been country-focused. Much has been written on offsets in Western Europe, Japan, United States, Korea, South Africa and Taiwan, as well as countries in South East Asia, such as Singapore and Indonesia.[40] However, most of these studies have not examined empirically the effectiveness of offsets on their industrial and technological development.

Literature on Malaysia, mostly focuses on the impact of foreign direct investment, joint ventures and globalisation on the civil sector, particularly manufacturing and agricultural industry. Greg Fleker, for example, looked at the impact of American and Taiwanese multinationals on Malaysia's electronics industry and the impact of Japanese and Korean industries on the heavy automobile industries.[41] Felker criticised the 1990's FDI policies for providing weak local technological capabilities, low indigenous participation, and shallow industrial structures with few linkages.[42] Other research examined the Malaysian Government's selective interventionist role in the process of industrialisation,[43] import substitution policy, the allocation of fiscal incentives for technological deepening and industrial growth,[44] rent seeking behaviour, technology policy, the strategy towards industrialisation, and the adoption of the *'Look East Policy*[45] towards industrialisation.

Studies have also been undertaken evaluating industrial competitiveness, sustainability and industrial diversity.[46] Sanjaya Lall, for example, pointed out that R&D is an important tool of competitiveness for absorbing and keeping up with advanced technology, raising the sophistication, increasing local content and reducing the cost of technology imports. He noted that whilst Malaysia was not at the stage of developing frontier technology, R&D investment was still needed to feed into routine engineering activity to improve quality, management, maintenance, adaptation and productivity.[47] A study by Masayuki Kondo argued that Malaysia's National Science and Technology policy has wrongly emphasised the element of science and not technology.[48] He calls for greater emphasis on technology policy with industrial orientation as a more effective method to enhance industrial competitiveness.[49]

Due to the commercial and political sensitivity of offsets, there is a dearth of literature on Malaysia's defence industrialisation and offsets performance. In fact, there has been no published data on the impact of defence offsets on Malaysia's technological and industrial development. This is an unexplored area and thus subject to much uninformed debate. Offsets have been claimed to transfer high-end value-added technology into the defence and civil sectors, promoting skills development and value-added employment in Malaysia's manufacturing sector.[50] Observers are concerned as to whether these developments are sustainable and long term.[51] Thus, an evaluation of Malaysia's offsets performance is timely.

The Malaysian Group for High Technology (MIGHT) conducted a study in 2000 evaluating the impact of offsets. The study evaluated past offsets obligations leading to policy recommendations as well suggestions for a structured offsets policy. The study identified weaknesses in the offsets processes, including an absence of codified policy and the lack of both consistent objectives and the monitoring of results.[52] However, the recommendations from this study were not adopted by the Malaysian government due to the inaccuracy and inadequacy of data. Importantly, there was an absence of recent important arms purchases in the Report and the lack of recognition that there had been a re-delegation of the offsets function from the Ministry of Finance to six key ministries, transforming the overall offsets implementation process.[53]

In 2001 and 2003, respectively, consultants from Denel Pty Ltd, South Africa and the Defence Export Services Organisation, (DESO), UK, through bilateral arrangements were invited to advise on Malaysia's offset strategy. However, the resultant advisory reports were policy recommendations lacking in any empirical research. The present study, therefore, will be the first to empirically evaluate the effectiveness of offsets as a facilitating mechanism for supporting Malaysian industrial and technological development in the defence sector.

1.7 Techno-Vision

Developing countries view offsets as a 'third way' for industrial and technological development.[54] Offsets are normally used to acquire sensitive, high-end and critical technologies that cannot normally be purchased off-the-shelf. The first and second wave of technology transfer was in the form of Import Substitution (ISI) and Export Orientation (EOI) Industrial Policy. Developing countries associate economic progress and development with industrialisation. Historically, these countries have transformed from agricultural-based economies into modern diversified economies. These countries often link the success and richness of the western world to industrial and technological prowess.

In countries such as Mexico, Brazil, Argentina and the NICs, ISI was introduced to develop indigenous capability. However, the failure of this strategy forced governments to switch in the 1970s to a more labour intensive export-oriented industrial growth.[55] Concessions and tax relief as well as various incentives provided an attractive platform for inward investment.[56] Although the switch to an export–oriented industrialisation (EOI) strategy gave fresh impetus to industrial growth, the governments of these countries realised that the MNCs were merely transferring obsolete technologies; there was thus a major vacuum in terms of skills and capability.[57] Many of these countries now practice a combination of ISI and EOI strategies in their industrial and technological development process.

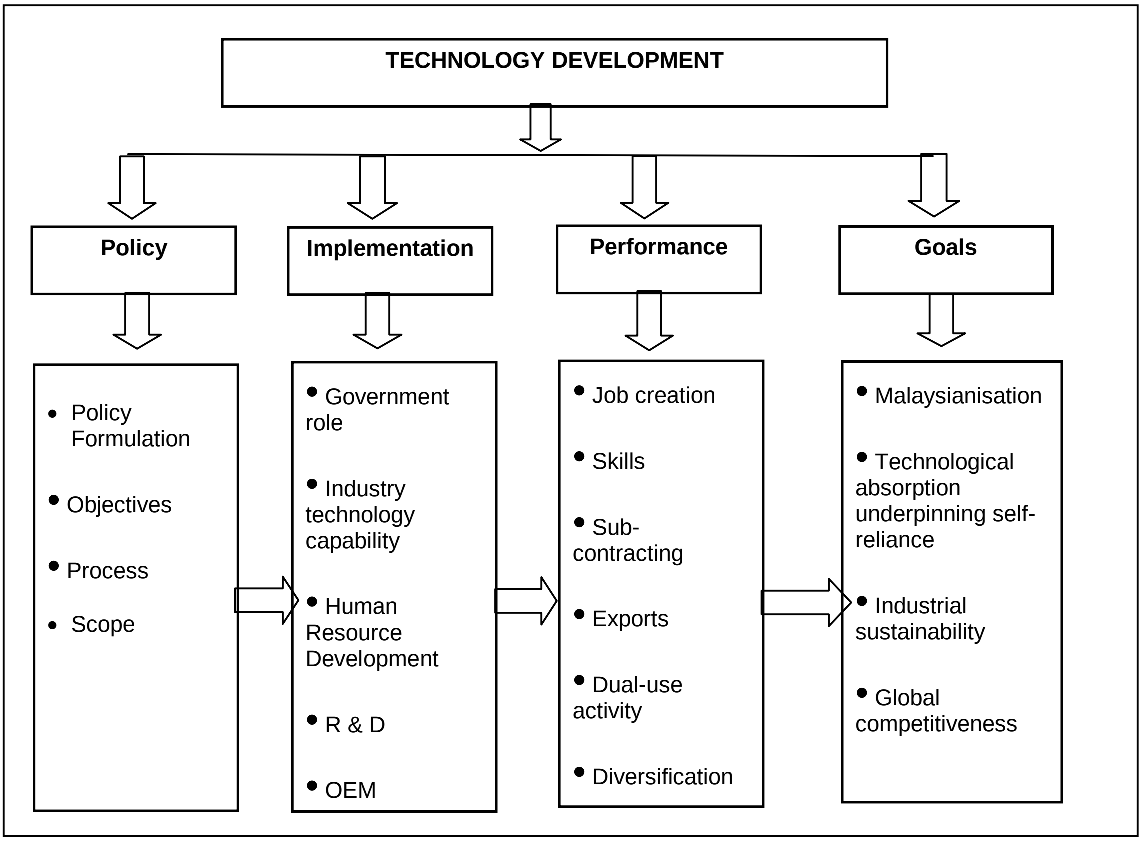
Malaysia has moved in similar directions as other developing countries in its industrialisation process. Malaysia's geo-political position, attractive economic climate, pool of highly educated workers and broad panoply of government incentives made it a potential regional technology development hub. Offsets have the potential to move Malaysia up the high-end technology ladder. For successful technology transfer, Malaysia's primary purpose must be to provide a systematic offset strategy to create sustainable and competitive industries, with localised capabilities to design, develop, integrate, maintain, as well as use the knowledge to diversify into civil industries. **Appendix B** explains Malaysia's route to national prosperity.

Effectiveness is defined as producing the intended or desired results. Measurement of effectiveness should be based upon attainment of goals and progress towards achieving the intended objectives. Effectiveness in the context of this research refers to the indicators that may assist in assessing a nation's offsets objective(s). These indicators will determine whether offsets have been more or less successful as a tool for technological and industrial development in the identified areas.

There are four principal elements of Malaysia's offset 'model': policy; implementation; benefits; and goals. This conceptual model, called 'Techno-Vision', is abstracted from Malaysia's 'Vision 2020' policy, which aims to create both effective utilisation of current technology and increased absorption of new technology to assist the industrialisation process, enhancing Malaysia's international competitiveness.[58] The 'Techno-Vision' model at Figure 1.3 will form the conceptual model for this study.

The Techno-Vision model is divided into four principles. Firstly, at the policy stage, the process begins by formulating an offsets policy which clearly defines the objectives, processes and implementation mechanisms. Once the policy has been formulated, offsets are then utilised as a facilitating mechanism for Malaysia's industrial and technological development. Offsets arguably provide the platform for the development of high-end technology transfer into the defence sector to support defence industrialisation, industrial diversification, value-adding supply chain activity, and knowledge and skills development to undertake through-life support of equipment, creating a competitive and sustainable industry in the long term.

Figure 1.3: Techno-Vision Model for Malaysia



Source: Author

At the second stage, the transfer process cannot be materialised without cooperation and commitment from various actors involved in the offset processes, namely, the government, sellers, local firms and other relevant third parties. Offsets for developing countries require a 'strategic partnership' as an underpinning factor for success. A strategy is formulated for the parties to collaborate and form strategic *alliances,* which will then converge towards an effective transfer process. The government acts as the key player in driving and ensuring the effective implementation of policy by laying the foundation for successful technology transfer. The government's initiative and commitment towards driving the overall offsets process is a critical element in ensuring the effectiveness of the offsets mechanism. As offsets are a government-driven tool, the latters's direct involvement in policy planning and implementation is crucial for ensuring the effectiveness of offset implementation. Local firms must be able to invest in manpower training and R&D, and have the capability to absorb and commercialise technology. Sellers and their governments will be evaluated in terms of their commitment towards offsets implementation. Third parties assigned to undertake offsets obligations on behalf of the main vendors play an important role in ensuring that obligations are fulfilled.

At stage 3, once the policy and implementation is in place, there will be tangible outputs or benefits in the identified areas, including technology development' job creation, skills development, industrial diversification' value-added, inter-industry linkages, export opportunities and marketing. Finally, at stage four, these benefits culminate to create a sustainable and competitive indigenous Malaysian industrial base, underpinning self-reliance.

1.8 Research Methodology

1.8.1 Foreword to Research Methodology

The section begins with a brief explanation of the reasons for conducting research and the nature of research methodology. This is followed by an explanation of a research philosophy, process, typology, design, and finally, the research plan. Research is not just about collecting data or information without any purpose and without interpretation; it is also a process of enquiry and investigation.[59] Research requires a clear purpose as to why it is being undertaken, as well as awareness of the application of systematic techniques to pursue an investigation, the ability to interpret data and also the issues of ethics and validity. A research methodology, on the other hand, refers to the procedural framework within which the research is conducted. It describes an approach that can be put into practise in a research programme or process.[60]

This study's approach is undertaken based on a combination of reasons. These include reviewing and synthesising existing knowledge on the subject of industrial and technological development through offsets. There is a need to describe the Malaysian offsets policy, explain the processes and implementation, understand the role of the various players, the strengths and weaknesses of the policy, as well as the challenges faced in obtaining a positive outcome. Finally, there is a need to analyse the research problem to obtain an outcome reflecting the impact of offsets on Malaysia.[61] The outcome is used to make policy recommendations to the Government of Malaysia and other stakeholders. [62]

1.8.2 Research Philosophy

According to Saunders, there are three major ways of thinking about research philosophy-epistemology, ontology and axiology.[63] Epistemology relates to the acceptable knowledge in a study. Here, the issue is whether the social world should be studied according to the same principles, procedures and ethos as the natural sciences. There are two approaches of how one can approach empirical research which are positivistic related to natural sciences, and phenomenological or interpretivism related to social science.[64] The positivistic approach is more commonly used in the natural or physical sciences**.**[65] This approach seeks to identify measure and evaluate any phenomena and to provide a rational explanation for it. This explanation will attempt to establish links and relationships between the different elements of the subject and relate them to a particular theory or practice. Positivism is normally based on a quantitative approach which relates to the collection and analysis of numerical data whereby results are collated and presented statistically. This method concentrates on measuring data using scale, range and frequency. These include surveys, experimental studies and cross-sectional studies. The positivistic approach also adopts the deductive method where research moves from general ideas or clear theoretical positions to specific situations prior to the collection of data. Theories and definitions gathered will be analysed and results presented based on the data collated. This method of research deduces a hypothesis, tests that hypothesis and explains the causal relationship between variables.

The phenomenological approach, on the other hand, looks at research from the perspective that human behaviour is not as easily measured as in the natural sciences. This perspective assumes that people will often influence events and act in unpredictable ways that upset any constructed rules or identifiable norms. Research methods are therefore chosen to try to describe, translate and explain events from the perspective of people who are the subject of research. This perspective normally or often involves qualitative research, examining and reflecting on the less tangible aspects of research such as perception, commitment and trust,[66] and is often more difficult to interpret and present findings. This phenomenological approach includes case studies, interviews, action-research and grounded theory. Research philosophy to a large extent influences the research methodology adopted for a particular research project. Here, the inductive method is used where research moves from a particular situation to make or infer broad general ideas and theories. Information and ideas are gathered from a range of people and these data are then collated and the results analysed, and presented leading to a new finding or otherwise.[67]

Ontology, on the other hand, deals with the nature of reality. This raises assumptions about the way the world operates. There are two aspects to ontology: objectivism and subjectivism. Objectivism asserts that social phenomenon and their meanings have an existence that is independent or separate from actors. Subjectivism suggests that social phenomena are created from perceptions and consequent actions of social actors.[68] Through a continual process of social interaction, these social phenomenons are in a constant state of revision. The role of value in all stages of a research process is of great importance for credibility.

However, another line of argument to the whole research philosophy is to adopt the pragmatic view where the determinants of the research philosophy are based on pragmatism. A pragmatist argues that the most important determinant of the research philosophy adopted is the research question. Further, if the research questions do not provide a clear indication as to which method to use, the pragmatist approach may be the best option.[69]

For the purpose of this study's research, the pragmatist philosophy is adopted by incorporating aspects of the positivistic and phenomenological approach as well as the objectivist and subjectivist approach. The positivistic, deductive approach is used to understand and gather information on existing theories through structured interviews and questionnaires. Quantitative data include surveys using questionnaires and structured and semi-structured interviews. The inductive approach is used to further enhance the questionnaires and interview results. The positivistic approach is used to obtain quantitative information in terms of value, types, categories of offsets programmes and ranking in terms of impact on the Malaysian offsets recipient companies. The semi-structured interview is also used to gather information from supplier companies.

The phenomenological, inductive approach is used to gather qualitative data by interviewing respondents in each firm to obtain further information on the extent to which offsets have been effective, better understanding the operations of the firm as well as the challenges it faces. The Qualitative methods are also used to observe discussion and intent in meetings, sieve through minutes of meetings to identify patterns, taking note of issues pertaining to the research. Qualitative data includes open interviews and participatory observation.

The ontological aspects in this research employ a combination of objectivist and subjectivist approaches. In studying the role of offsets and how they have impacted on defence industry development in Malaysia, the study uses offsets managers in defence companies as research subjects. The objectivist position is used by the researcher to study the reality of the organisation in relation to current technology capability, operating procedures, human resource capability and infrastructure. The subjectivist approach seeks to obtain feedback through interviews; the perceptions of individual offsets managers and how they interpret events and challenges faced due to the practice of offsets.

1.8.3 Typology of the Research

Research can be classified in several ways. This study focuses on two issues: the level of management activity and the nature of the research problem. Research types according to the nature of the problem include exploratory, descriptive, analytical and predictive methods. Exploratory research is undertaken when few or no previous studies on the subject exist. The aim is to look for patterns, hypotheses or ideas that can be tested which form the basis for further research. Descriptive research can be used to identify and classify elements or characteristics of the subject. Analytical research often extends the descriptive approach to suggest or explain why or how something is happening and finally predictive research aims to speculate on future possibilities, based on close analysis of available evidence of cause and effect. This study uses a combination of all research types against the levels of management activity as summarised in Table 1.2, below.

Table 1.2: Level of Management Activity

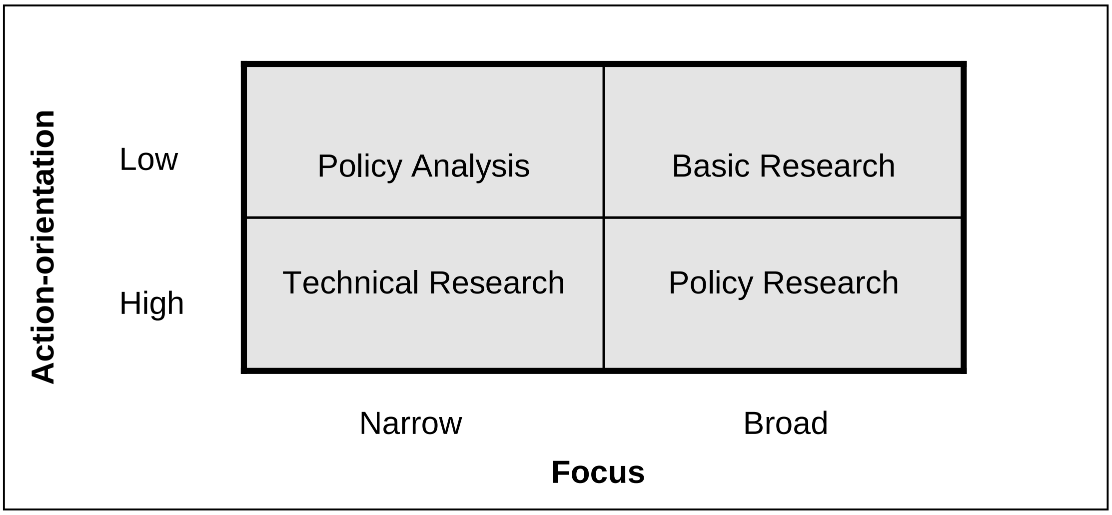
Level	Nature of Research
Strategic activity	This includes research related to strategic planning and marketing. An assessment of indicators that measure critical elements of the economic, social, political and technological environments is often undertaken using approaches such as the Delphi techniques or nominal group techniques. This type also includes policy research such as how policies are formulated and whether specific programme or policy objectives have been met
Managerial or tactical activity	This type of activity deals with product and market development, the enhancement of managerial functions such as finance and human resource development, and the implementation of the marketing mix. Data generated through ongoing operations will feed into the management decisions to be made.
Operational activity	Operational activities have a narrow focus and deal with day-to-day functioning of the organisation. Research at this level is aimed at determining the most efficient action given a specific set of circumstances.

Source: *http://www.ryerson.ca/-* mjoppe/ Researchprocess/TypologyofReserach.htm dated 8/11/2006

In relation to the level of management activity, the research questions clearly suggest that this study falls into strategic activity as *policy-oriented research*. A research approach concerning a firm or industry is considered as management research but when actions of governments are required, it becomes policy research.[70] Majchrzak has presented a typology of policy research based on action orientation and focus.[71] Action orientation is concerned with the utility of results. The focus is concerned with the specificity of the research question whether the research question is specifically or broadly defined.

Majchrzak has segmented policy research into four groups - basic policy research,[72] policy analysis,[73] technical research and policy research as per figure 1.4, below. Technical research is focused on resolving a very specific, narrowly defined problem, such as the impact of defence offsets on supply chains in Malaysia. Here, the case focus is narrow with a high action orientation. Policy research, on the other hand, has a broad focus with high action orientation. For example, a study on the impact of defence offsets on Malaysia's defence industrial and technological development may fall under this category. This study is then a policy oriented research with a broad focus and high action orientation and the findings of the research will be used to make policy recommendations that could be used by the government to solve certain problems. This research also provides policymakers with the required information and options to find solutions to complex issues, and falls between technical and policy research in the Figure 1.4 framework.

Figure 1.4: Typology of Policy Research



Source**:** Majchrzak, *Methods for Policy Research*, Sage Publication**,** London, 1984, p.13.

The study is exploratory as there have been few studies on this subject, and none on Malaysia. The descriptive approach is used to collect, analyse and summarise data on the volume of offsets and scope of offsets, policy, processes and implementation procedures. The analytical approach in this study includes analysing the data to evaluate the impact that offsets have had on Malaysia's defence industrial base as well as the benefits accrued and costs derived from offsets. A predictive approach is finally taken to speculate the outcome of the studies and suggests policy recommendations based on the analysis of the available data.

1.9 Research Design

1.9.1 Multi-Method Strategy

As the present study requires in-depth research, using all of the above approaches, a multiple research method is most likely to avoid bias in the results. Such an approach is described as one of convergent, multi-method/multi-trait, convergent validation, otherwise known as the T*riangulation methodological method.*[74] This approach uses mixed methods to capture a sense of reality.[75] The term 'triangulation' is defined as obtaining evidence from multiple sources using quantitative and qualitative techniques and procedures in combination, as well as use of primary and secondary data to ensure that a non-biased view is obtained from respondents.[76]

In business and management research, the term triangulation refers to evidence from multiple sources, ensuring that a biased view is not obtained from one informant. The essence of triangulation is to attempt to corroborate any evidence that is supplied either by speaking to another individual or by document analysis.[77] Data collection for the present study consists of a combination of quantitative and qualitative method such as surveys, interviews, case-study analysis, documents, reports, books, archival materials, journals and newspaper clippings. Such combinations provide the researcher with a solid grasp of data content as well as enhancing the credibility of research results. The approach also improves the researcher's judgement by collecting different kinds of data on the same phenomenon. The triangulation method provides a more complete and holistic portrayal of the unit under study.

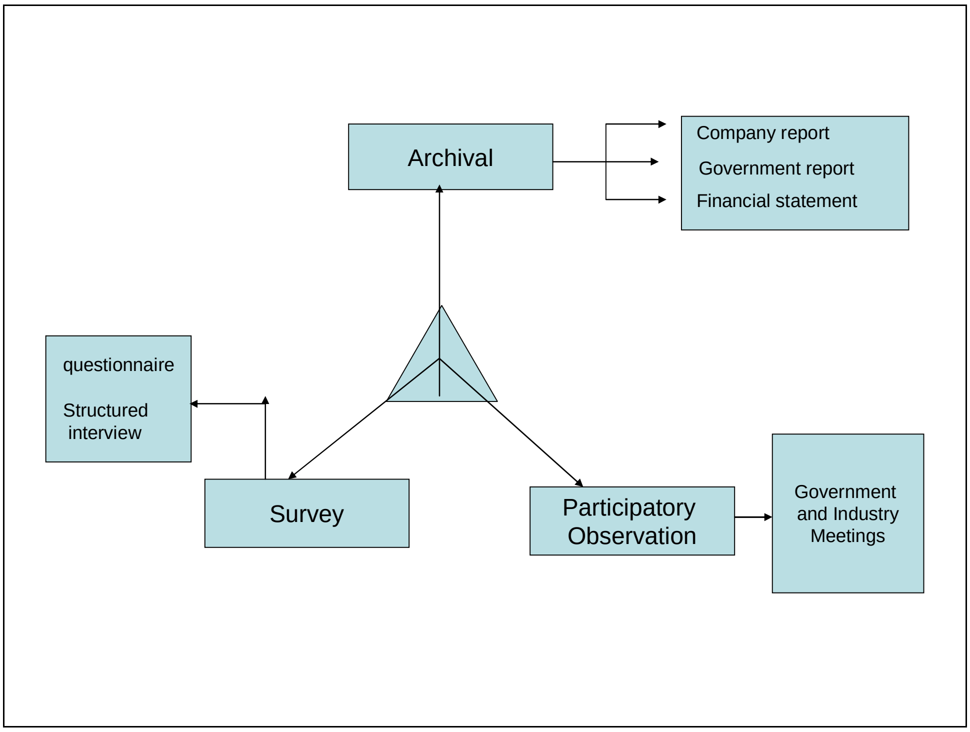
There are several advantages in using a triangulation method for this study's research. Firstly, it allows for empirical evidence to be obtained from multiple sources such as questionnaire, semi-structured, structured and open-ended interviews as well as via participant observation, mutually reinforcing or otherwise the results from analysis. The researcher is able to corroborate and be more confident of the results. The different designs complement each other, with results obtained through the questionnaire from Malaysian companies, and structured interviews with OEMs and open-ended interviews with government and other agencies being cross-checked through participant observation and the archival research method.

The researcher found that multiple sources of evidence can create several disadvantages. The practice of combining both quantitative and qualitative approaches required the researcher to spend additional time mastering both methods using different strategies and having differing epistemological and ontological implications.[78] Further, the researcher needed to know how to carry out the full variety of data collection techniques because if any of the techniques had been used incorrectly, the opportunity to address a broader array of issues or to establish converging lines of inquiry might have been lost.[79] Data collection using multiple sources was also found to be more expensive and time-consuming as compared to collecting data from a single source.[80] This study's research was conducted by adopting the multi-method research, as illustrated in Figure 1.5 below.

1.9.2 Archival Research

The initial research design used in this study was archival based (also termed documentary secondary data).[81] Saunders categorised this design into three subgroups, namely, documentary data, survey-based data, and data compiled from multiple sources. Figure 1.6 illustrates in detail the subgroups and the components within each group in detail. Documentary written material concerned with organisational records, including the recipient firm's personal production, notes, emails and letters and websites. The secondary data for this research were collected from the Malaysian Defence Industry (MDIC) website, MITI, EPU and EPICOS website. Data were also obtained from various government publications including the Vision 2020, New Economic Policy and later the National Development Policy, Science and Technology Policy, Defence Policy, Industrial Master Plan and the Five year Malaysia Plan. Archival data were also sourced through access to government procurement contracts, MOUs on offsets, bilateral defence industry meeting minutes, blueprints, HANSARD. Non-governmental reports, including publications by the United Nations Conference on Trade and Development (UNCTAD), World Bank, International Monetary Fund (IMF) and the Asian Development Bank. Finally, information was also sourced from conferences such as the conference papers of SMI, American Association of Countertrade Conference, the Countertrade and Offsets (CTO) magazine and other relevant internet sources.

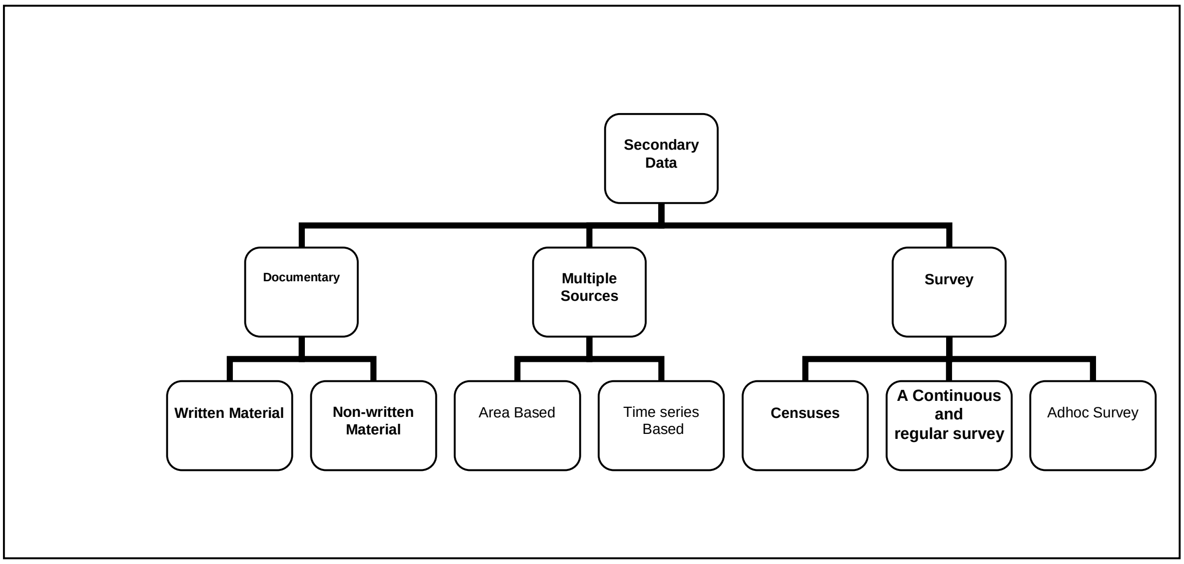
Figure 1.5: Triangulation Methodology



Source: Author

Non-written materials accessed include CD-ROMS of Malaysian and overseas defence companies, CD-ROMs containing lists of Malaysian defence industry members, taped press release and speeches of ministers and defence product launches at defence exhibitions. Area-based reports for this research include the *Malaysian Defence Industry Bulletin* produced by the MDIC, *Asian Defence and Diplomacy* which reports on offsets and defence industry matters in Asia, and the *Asia Pacific Defence Reporter* covering a wide range of news on South East Asia. Census data were also obtained from the Malaysian Statistics Department on the Malaysian industry production capability according to type of industry and from the Malaysian Industry Development Authority (MIDA) on the 21st century performance and challenges to the Malaysian industries. The MIGHT Report Survey 2002 was also used to validate the author's primary data.

Figure 1.6: Nature of Secondary Data



Source: Mark Saunders, Philip Lewis and Adrian Thornhill, *Research Methods for Business Students,* 4th Edn, Prentice Hall, Harlow, 2007, p. 64.

1.9.3 Survey

Surveys, part of the deductive approach, are commonly used in exploratory and descriptive research. In this respect, questionnaires, and semi-structured interviews were used to obtain data. Survey methods included face-to-face discussion, telephone interviews, questionnaires or a mixture of these. There are two main types of survey: a descriptive survey which is concerned with identifying and counting the frequency of a particular response among the survey group and an analytical survey which involves analysing the relationship between different elements in a sample group. Structured interviews, on the other hand, consist of a standardised interview, entailing the administration of an interview schedule by an interviewer.Structured interviews provide standardisation in both the asking of questions and the recording of answers. Structured interview questions can be closed, close-ended, pre-coded and fixed choices.[82]

In this study's research, two sets of survey questionnaires were employed to evaluate the effectiveness of offsets - one on the Malaysian defence industry offsets recipients and the other on the suppliers of defence equipment to Malaysia. The survey involved selecting a one hundred percent sample from the population group. The questionnaire focused on both descriptive and analytical aspects whereby data were gathered by counting the frequency of certain responses and analysing the relationship between different factors involved in the research. There were face-to-face and telephone interviews. Structured and semi-structured interviews were conducted with the defence suppliers. Semi-structured and open-ended interviews were held with government officials from the Ministry of Defence: Defence Industry Division, Procurement Division, STRIDE, MOF, MITI, MIDA and MIGHT.

1.9.4 Participant Observation

The third method of data collection used in this study's research was participation observation, also called ethnography by some researchers. This is a qualitative type of inductive research method. Participation observation refers to a technique where the researcher becomes completely immersed in the situation which is being researched. In participant observation, the researcher can take several roles. Gold divided researchers into four types: complete participant; participant as observer; observer as participant; and complete observer. Mark-Easterby, however, adapted this into a management approach and classified the researcher role into researcher as employee, researcher as the explicit role, interrupted involvement and observation alone. In this research, the researcher acts as the employee, where the researcher works within the government alongside the local companies and OEMs. The participant observation approach is suitable to this research due to several reasons. Firstly, the researcher is employed by the Ministry of Defence, Malaysia. The researcher has first-hand experience of policy formulation as well as the process and implementation of offsets. The researcher's work experience in this field facilitated the observation method of data collection due to familiarity with government officials, Malaysian companies and offsets recipients and defence suppliers.

The researcher faced no problems obtaining access to the offices of MOD and local companies. The MOD Secretary General (2003-2005) was responsive and championed the project. A letter was issued by the Secretary General requesting industries to cooperate and provide access to data. The researcher contributed during the fieldwork through sharing of knowledge on the subject of offsets, conducting workshops and organising a conference to create awareness of offsets .Other observations included analysing the minutes of various meetings and reviewing classified reports and correspondence. The preliminary research findings were presented to the subjects of the research through a workshop. The workshop themed ‘Making Offsets Work’ was held in Kuala Lumpur on 12 July 2005. The workshop was received positively by the participants. As some of the issues raised in the findings could be sensitive, the researcher ensured that the names of individuals and organisations were kept confidential.

Participatory observation was conducted at various levels, including attending high-level policy meetings, workshops, conferences, attachments at the MOD and selected local and overseas industries. Data collection was generated through participant observation, including primary, secondary and experiential. At the primary level, data were collected mainly using a diary and note-taking of what was said between research subjects. At the secondary level, descriptive observation was undertaken through the systematic reporting of events, mainly of conversations that took place during meetings and discussions. The time, date and venue were recorded for diary purposes. A narrative account was undertaken by immediately reflecting on the issues and identifying ideas and key trends from the descriptive notes. Due to the sensitivity of the subject matter and to safe-guard the identity of research subjects, no tape recordings were undertaken.

The researcher took an employee-researcher or participant observant approach to data collection. Research subjects were aware of the researcher’s presence and were briefed as to the research objectives. The researcher’s presence did not intimidate the subjects. The researcher’s background and familiarity amongst research subjects mainly government officials and representatives of Malaysian and overseas defence companies helped build close rapport, gaining the trust of the target audience. In fact, many issues were openly discussed in a positive manner. Many of the research subjects were objective about the research and were willing to cooperate.

1.10 Research Plan

This section describes the research plan in relation to the study methodology developed in the previous section. Phase one of this research aimed to undertake a critical review of the secondary literature to establish both the theoretical foundations as well as the literature gap. A critical evaluation was done of the archival sources, encompassing books, journal articles, newspaper clippings, specialist reports, and published and unpublished government reports. Books and journals were mainly obtained through the Cranfield Library and the inter-library loans from various places such as the Bodleian library, British Library, Radcliffe Science Library, Oxford, and the JSCSC library at the UK Defence Academy. Journal articles were sourced on-line via Cranfield University's A-Z resources: EBSCO, Taylor and Francis and Jane's were the more relevant sites for this study. Journals such as Defence and Peace Economics, International Technology Development, Development Studies, and Jane's Defence Weekly were frequently used throughout this research. The literature base was used to explore the theories relating to economic development, industrialisation, technological development, and the role of offsets.

1.10.1 Pilot Study

Next, a pre-test or pilot study was conducted to detect possible shortcomings in the design and use of the questionnaire. This was conducted through a pilot study of the Malaysian beneficiary of the UK JERNAS Short Range Missile System offsets programme. There are five beneficiaries: the Malaysian army; SME Aerospace; the MMC Engineering enjoying direct offsets relating to the equipment; the Defence Industry Division on offsets training and attachment; and the Malaysian Armed Forces through indirect offsets involving the Electronic Warfare School. This was purposive sampling based on the availability of data, the project nearing completion and the researcher's past work attachment to MBDA. The questionnaire was also circulated to the Ministry of Defence, Malaysia, the Malaysian Defence Industry Council, DESO, UK, and MBDA, UK for comments. The pilot study provided feedback on the structure of the questionnaire and issues relating to the commercial sensitivity of certain issues.

Malaysian firms had problems separating out the offsets and non-offsets impacts, as most of them did not directly separate the two activities in their reporting system. Mary Bell, DESO, UK, advised the author to reduce the number of questions as most commercial firms will not have the patience nor time to complete a bulky questionnaire. The questionnaires were later modified based on the various inputs provided.

1.10.2 Fieldwork

The fieldwork was jointly sponsored by BAE Systems, Cranfield University and the British Council. Fieldwork to obtain data was undertaken in several stages. First, through an attachment with the Defence Industry Division (DID), Ministry of Defence, Malaysia, for a period of three months (30 April till 30 July 2005). During the attachment, procurement and offset contracts were accessed to interrogate data on procurement volumes, types of equipment purchased, as well as the type and numbers of offsets recipients linked to the suppliers. Records obtained from the Ministry of Defence indicate that up to 2000, there were 240 offset programmes involving 54 beneficiaries.[83] Programme beneficiaries comprise the Malaysian Armed Forces, other government and semi-government agencies, research organisations, universities and defence and civil companies. Many of these beneficiaries are recipients of more than one offsets programme.[84] A detailed list of beneficiaries and the breakdown of the programme up to the year 2000 is shown at **Appendix C.**

Questionnaires were sent out via e-mail and posted with instructions on how they should be completed. Follow-up calls were made to ensure that the questionnaires had reached designated parties, that they had understood and were able to complete them without difficulty. Completed questionnaires, were then either emailed or collected personally by the author during the industry fieldwork visits. Pre-appointments were made to meet designated offsets programme managers or coordinator of firms, collect the questionnaires and also to further probe for information. The set of survey questionnaires was sent to 100% of the offsets recipient population. The target group for the questionnaire were offsets programme managers of each company. The population of defence-related firms in Malaysia is shown in Figure 1.6, comprising 46 firms (100%) embracing eight aerospace, six maritime, three weapons, six automotive, 13

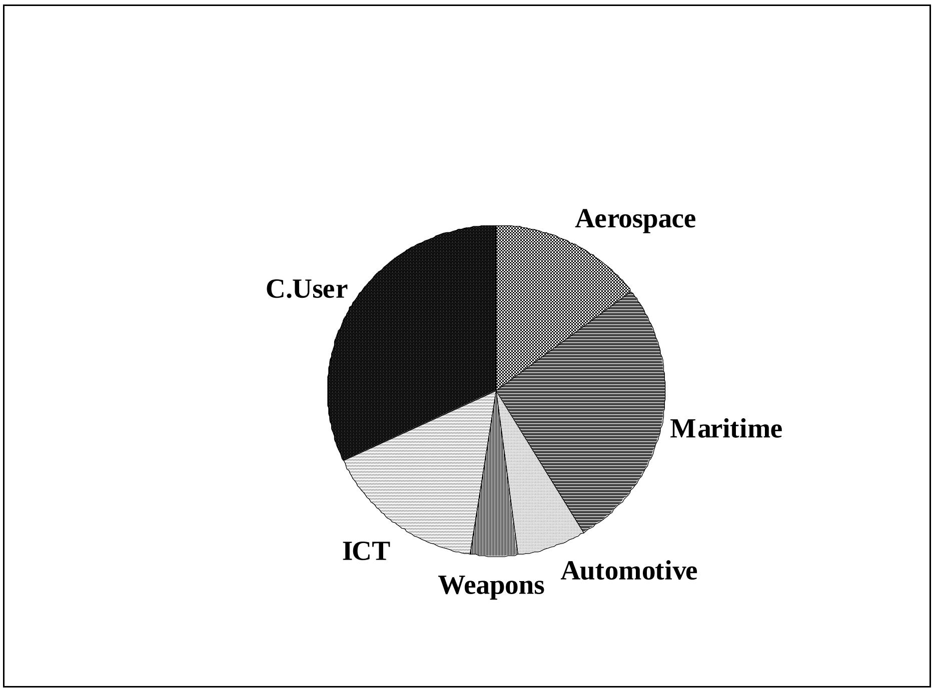
ICT and 10 common user firms.[85] However, not all of them are recipients or benefits through offsets. Some 21 defence firms across the various sectors, excluding common user items, were identified as offset programme recipients based on the MOD, Malaysia records and the 2002 MIGHT Report. Questionnaires were sent out to the 21 firms, 100% of the offsets recipient population, and responses were received from 16 of these firms, a response rate of 76%.[86] The size, ownership and capability of these companies varies from large government-owned companies with comprehensive infrastructure and facilities to small, privately-owned firms, acting as mere trading companies. The full list of identified companies surveyed and their background is as shown at **Appendix D**. Most of these companies are private-owned, based in an identifiable industrial hub or located close to Armed Forces' infrastructure and support facilities. Geographical distributions of the population where questionnaires were sent are shown in **Appendix E.**

The questionnaire as per **Appendix F** contains two introductory letters, one from Cranfield University and the other from the Ministry of Defence, supporting the research. The questionnaire is divided into seven sections with several questions in each section. The questions were prepared based on the research aim and key themes identified through the literature review and theoretical framework. The questionnaire has both open and closed questions. The closed questions have a combination of different types of questions. These include lists questions as per questions 1.07 and 2.01; category questions as per questions 2.02, 2.03, 2.04 and 2.05 and ranking questions as per question 4.06. Samples of open questions include questions 3.0-3.05, where responses capture R&D issues as well as part E, questions 5.01-5.09 on the impact of offsets. The Questions are focused on the following issues:

i. Capturing the impact of offsets on Malaysia's defence industry.
ii. Evaluating offsets recipient company operations and human resource development strategy.
iii. Evaluating indigenous firms' technology development capability.
iv. Assessing the type and quantity of technology transfer through offsets.
v Analysing offsets policy and implementation issues.

The questionnaire incorporated issues such as offsets processes, technology development issues, research and development, supply chain management, skills development, export expansion as well as seeking recommendations on the way forward for these companies.

Figure 1.7: Distribution of Malaysian Defence Companies, by Sector



Source: Ministry of Defence, Malaysia (MOD), *Malaysian Defence Industry Council,* [online], (MOD, Kuala Lumpur, 2006), (Accessed: 30 September 2004), Avialable via: www. mod.gov.my.

Fieldwork also involved sending out a second set of open-ended questionnaires as per **Appendix G** to 16 defence suppliers. 13 responded to the questionnaire. Some of the responses to the questionnaire were received via email and some were physically collected. There are three parts to this questionnaire with part 1 focusing on company details, part 2 on offsets obligations and part 3 on supplier offsets strategy. In total there are 26 questions and a table to be completed. The questions are all open-ended questions. A list of the companies and their backgrounds are shown per **Appendix H.** Follow-ups were made to ensure that respondents had received the questionnaire. Responses were then obtained from those companies via email. In the case of the UK suppliers to Malaysia, fieldwork trips were made to obtain more information. Visits were made to BAE Systems, Vickers (BAE land now), Westland Helicopters (Agusta Westland now) and MBDA, UK. For other respondents, face-to-face interviews were held with the supplier company offsets managers or country managers based in Malaysia. The interviews were all conducted during the fieldwork survey.

Issues that were raised in response to questions in the open-ended questionnaire were focused on:

i. Definitions of technology.
ii. Conditions for technology transfer and supplier government policies to technology transfer.
iii. Views of Malaysian company capability, strengths, competitive positioning and weaknesses.
iv. Cost of offsets (technology).
v. Sustainability of partnerships.
vi. Policy and implementation issues.
vii. Preference of offsets for developing countries.

Interviews were also conducted with defence contractors having offset obligations in Malaysia, namely, from the United States, Britain, France, Italy, Russia, South Africa and Brazil. The views of these foreign companies were obtained on the role of offsets in facilitating technology transfer in Malaysia, the push and pull factors, local industry capability in terms of technology absorption, research and development. Interviews were aimed at identifying government policies and technology export restrictions, including recent developments in the area of offsets.

Finally, interviews were conducted with Department Heads and key personnel in offsets-related government and non-government agencies to obtain their views on the role and effectiveness of offsets as a facilitating tool for Malaysian industrial and technological development. Interviews were scheduled with the Secretary General, Ministry of Defence and the Chief of the Armed Forces, Malaysia, to obtain their views on the Ministry’s future policy. A list of the agency representatives interviewed is shown in **Appendix I.** Interviews with representatives of government agencies angled in on issues related to the government vision, mission and objectives regarding technology development, the role of offsets in national development policies, indigenous technology development capability, and offsets policy and implementation issues.

Field trips were also made to the Offsets Management Offices and related organisations, including the UK DESO offsets office, Madrid ISDEFE offsets office and the Czech Republic BAES offsets office to obtain their views on the impact of offsets in the development of a local technological and industrial base. The organisations that were approached are shown at **Appendix J.** The field trips, on the whole, provided interesting points for pursuing a gap analysis between buyers, sellers and government, as well as obtaining other offsets-related agencies views on the practices and challenges of 'effectively' employing offsets in the technology transfer process. As the size of the respondent population for this research effort was small (less than 50), no sampling was undertaken. Follow-up research was undertaken through telephone interviews and emails; this was because of the lack of proximity to respondents as well as the high cost involved in travelling. [87]

1.10.3 Data Access

Access to data occurred via permission from the Ministry of Defence, Malaysia. The Defence Industry Division (DID) had the procurement and offsets contracts, offsets obligation lists, and data on value and recipients of offsets projects. The MOD was also extremely helpful in providing the support letter to interview offsets-related defence firms' representatives. Access to company documents and financial reports provided information on firm strategy, vision, mission, objectives, financial status, human resource development and research and development strategies, and also the types and levels of technology transfer. Visits included evaluating the workforce and its capability in terms of levels of education, innovation, and marketing capacity. A summary of the research plan is as per **Appendix K.** The Malaysian firms interviewed provided immediate access due to the importance and relevance of this study and the value of the research findings towards improving and further enhancing procurement and offsets policy and procedures. Issues of commercial sensitivity were raised by both local and international firms during the fieldwork process. However, due to the author's MOD background, both the Malaysian and international firms were receptive to the research and agreed to cooperate in providing data for the study.[88] There was an element of good will throughout the research process between the author, Malaysian firms, OEMs, and government agencies. The respondents appreciated the value and importance of this study as being objective policy-based research. Respondents were therefore content to discuss issues involved in the research. The respondents were advised that they would be allowed access to the research findings.

1.11 Data Analysis

1.11.1 Quantitative Data

Quantitative data were analysed using the univariate method. Frequency tables were used to calculate percentages belonging to each category of data as per the questionnaire. Category data were classified into sets, according to the characteristics ranked in order. Tables and charts were used to show the various types, categories, and levels of impact. Responses were calculated, based on the numbers of respondents against the total population. Table 1.3 provides a company distribution in terms of workforce proportion by type of activity. The frequency of company response is categorised according to the percentage bracket and type of activity. The total frequency of each category is then counted, and changed into percentages or numbers, based on the total number of responses, i.e 16.

As respondents numbered only 16, no software packages, such as SPSS, were used to analyse the data. Excel was used to obtain pie, bar and gantt charts which could then be used to interpret results. In relation to the semi-structured interview questionnaire responses from the suppliers, the answers were clustered according to the questions. These answers were individually analysed to identify similar themes and issues. For example, question 3.4 and question 3.5 asked the percentage of offsets cost that would be factored into the main procurement contract and the factors that could increase or reduce offsets costs.

Table 1.3: Distribution in Terms of Proportion of Workforce according to the Type of Activity

Question 2.04	Less than 20%	20-40%	40-60%	60-80%	80-100%	Total respondents
Management	11	5	-	-	-	16
Operation	1	4	2	8	1	16
Maintenance	3	8	4	1	-	16
R&D	14	2	-	-		16

Source: Malaysia Survey of Offsets Recipient Firms (July 2005)

1.11.2 Qualitative Research Analysis

Certain software packages such as (CAQDAS) computer aided qualitative data analysis software, Nvivo, ATLAS, ti, N6 and HyperRESEARCH are available in the market for qualitative data analysis. However, these software packages are not so widely practised and the researcher decided not to use any of these software packages for qualitative data analysis as they were unavailable at the university. Qualitative data were collected and analysed simultaneously. Each interview was immediately typed into the word processed file separately according to the relevant categories. The interviews were grouped into systematic themes based on the guidance of the theoretical framework and questionnaires. Interviews were not recorded due to the sensitive nature of the subject matter. Almost all interview notes were hand-written as the interviewees were not comfortable at being recorded. Issues were raised based on pre-conceived concepts or themes that had already been identified. Interview notes were immediately transcribed and keyed into the computer under separate headings in different folders. The folders were divided according to several categories as per Table 1.4, such as offsets recipient folders, OEM folders and government folders. Issues raised during the interviews by these various players were then further broken-down and clustered into broad themes as shown in table 1.5 such as policy, implementation, impact, benefits and costs. The main themes were then further broken-down into sub-themes as per Table 1.6. These themes were then separated and linked to consistent patterns and recurring issues.

Table 1.4: Categorisation of Folders

Folder 1 : Offsets Recipient's Questionnaire Reply				
Subfolder 1 Aerospace	Subfolder 2 Maritime	Subfolder 3 Weapons	Subfolder 4 Automotive	Subfolder 5 ICT

Folder 2 : OEM Questionnaire Reply				
Subfolder 1 British	Subfolder 2 EU	Subfolder 3 USA	Subfolder 4 Others	Subfolder 5 Eastern European Countries

Folder 3 : Government and other interviews				
Subfolder 1 MOD, Malaysia	Subfolder 2 Other government agencies	Sub-folder 3 Universities	Subfolder 4 Research think-tanks	Subfolder 5 Others

Table 1.5: Categorisation According to Research Themes

Folder 4: Research Themes				
bfolder 1 licy	ıbfolder 2 Implementation	Subfolder 3 Impact	Subfolder 4 Benefits	Subfolder 5 Challenges

Table 1.6: Examples of Sub-Categorisation of Themes

1. Policy

Num	Topic	Respondent name	Venue, Date and Time	Issues discussed
1	Objectives of offsets	XYZ	Defence Industry Division, MOD, 23 May 2005, 2.00-4.00p.m	• Does not reflect national objectives • Not-in line with the defence policy
2	Procurement Process	ABC	Procurement Division, 27 June 2005	• Complicated processes • Does not give sufficient weight to offsets

2. Impact

Num	Topic	Respondent name	Venue, Date an Time	Issues discussed
3	Technology learning	XYZ	DDE SMEA, Sg.Buloh,KL,3.00p.m	Offsets provide systematic documentation

Source: Author, October 2006

The researcher found the thematic approach to be less complex and cost saving. It was also very reliable as the researcher has first-hand experience of offsets policy formulation, and its process and implementation by the Malaysian MOD. Although the qualitative method is time-consuming, the researcher had the advantage of substantial background knowledge to the subject and recognised target groups to be interviewed.

1.11.3 Research Reliability and Validity

The researcher was conscious of the need to ensure credibility of the research findings. To reduce the possibility of getting a wrong answer, two important elements were particularly emphasised - data reliability and validity. Reliability refers to the extent to which data collection techniques and analysis will yield consistent findings.[89] The triangulation method was used to increase reliability, as different sources were used to reinforce research results. Robson identifys four threats to reliability - subject or participant error, subject or participant bias, observer error, and observer bias.[90] In conducting this study, to avoid participant error, the respondents were interviewed during their less busy times by pre-booking the appointments with their secretaries. This flexibility provided respondents with the chance to be in a relaxed atmosphere and to chat more freely without any interruption. In terms of subject or participant bias, in most cases, the CEO was met in the same organisation and interviewed separately to counter-check the accuracy and reliability of the data or information provided. However, in some of the companies, the CEOs were not available for meetings. Observer error was minimised as the author was the only person engaged in the conducting the whole fieldwork study, including distribution of questionnaires, and interviews. Observer bias was a crucial factor due to the author's background of having worked in the offsets environment and having dealt with many of these firms. Another important element in relation to reliability was the element of generalisability. This refers to whether the research findings may be equally applicable to other research settings. In this case, as offsets are country-specific, the research findings are unique to Malaysia and the theory cannot easily be generalised.

There are several types of validity such as face validity, concurrent validity, predictive validity, construct validity and convergent validity.[91] This research utilised the multi-method through comparing the same concept developed through data analysis with other methods to obtain validity. In terms of the validity of data, the research ensured that the findings were really what they appeared to be. Measurement was cross-checked by asking experts in the field, particularly the practitioners of offsets, both government and industry. There were potential problems in relation to the data as some of the answers obtained through interviewees were influenced by the researcher's previous position within the government. This problem was solved by cross-checking the results of interviews with questionnaire replies and archival sources. For example, some companies claim to have R&D facilities in the questionnaire but during interviews and participatory observation, it was clear that such facilities did not exist.

1.11.4 Research Values

Values in research relate to the researcher's personal beliefs or feelings. Values have regard to the choice of the research area, formulation of research question, choice of method, formulation of research design, data collection techniques, data analysis, and data interpretation to be held through-out the research process. The researcher had to monitor and control the extent of bias in the research process due to the researcher serving at the Ministry of Defence, Malaysia. The element of bias was controlled by ensuring that the data gathered from the various sources were triangulated. There was a tendency to exhibit sympathy towards local companies due to the closeness of long-term relationships that had been established between the researcher and the research subjects. The representatives interviewed view the researcher as a government 'missionary' and a target to vent their dissatisfaction. The researcher had to continuously emphasise to the research subjects, the purpose of the research and researcher's role.[92] This is where the triangulation method of data cross-checking between the various sources was extremely useful in validating data reliability.

1.11.5 Research Ethics

Ethics, in the context of research, refers to the appropriateness of behaviour in relation to the rights of those who become the subject of your work, or are affected by it.[93] A code of ethics provides a statement of principles and procedures for the conduct of the research. Research ethics must be adhered across all the four stages of research. At the first stage, the author ensured that the privacy of respondents is protected; that the time frame for the research was determined; and that interviews were conducted according to pre-arranged appointments. The author also avoided questions creating stress or discomfort, though there were data that could not be revealed by the respondents due to commercial sensitivity. The author also agreed that anonymity and confidentiality were strictly observed. During the second stage of design and initial access to data, the author maintained the position that no pressure would be directed towards the respondents enabling data access, and all information was to be provided voluntarily. At the third stage of data collection, the author strictly focused on the research project's aim. Finally, at the analysis and reporting stage, the author ensured that the data were not misrepresented, not selective, and did not report or misrepresent the statistical accuracy of the data collected.[94]

Research findings as well as policy recommendations are to be presented to the relevant stakeholders, primarily the Offsets Committee chaired by the Secretary General, Ministry of Defence, Malaysia. Copies of the dissertation will also be sent to the Prime Minister's Department, the Ministry of Finance, and the Economic Planning Unit for further action and implementation. The implementation schedule of overall research is shown at **Appendix-L.** The schedule over-ran by six months for two principal reasons: the fieldwork research took longer than expected and the researcher was also involved in various conference presentations in the second and third year of PhD programme.

1.12 Research Limitations

Several limitations of the research process revealed themselves. These limitations include:

i. Obtaining up-to-date information and data on offset programmes due to several movements of records: in the past, all records were kept by the Ministry of International Trade and Industry. This task was then handed over to the Ministry of Finance and currently all records are under the supervision of the Ministry of Defence.

ii. Delays in returning questionnaires within the stipulated timeframe by research subjects, leading to slippage of the research schedule.

iii. Unavailability of target groups (offsets managers) for interview. This was because most of them were actively involved in the day-to-day operations of their company. Appointments had to be altered or the researcher had to wait for a long time before the appointment.

iv. Frequent cancellation of appointments as the target group is at the upper management level and they lack the time.

v. Refusal by interviewees to commit to certain questions due to the sensitivity of the subject matter.

vi. Unavailability of systematic and structured data on offsets projects before 2001. The MIGHT report was used to capture data on offsets projects before 2001.

1.13 Study Road Map

After this chapter's scene-setting, Chapter 2 scrutinises the literature on economic development, particularly with regard to technological and industrial development. The chapter focuses on the differing theories and perspectives of economic development. It argues that technology and industrialisation have provided the combined impetus towards economic development in both developed and developing countries. The chapter also provides an insight into why nations choose to venture into defence industrialisation with its potential of contributing to overall technology development. Chapter two addresses the important definitional and scoping issues relating to technology transfer. Chapter three's discussion progresses by providing an in-depth evaluation of offsets and their role in defence industrialisation. This includes issues such as definitions, frameworks, mechanisms, tools and various models of offsets across the world. It then discusses the development of offsets in Malaysia. Chapter three also discusses strategic partnerships formed between the government, sellers, local firms and third parties in the offsets implementation process. Chapter 4 focuses on Malaysia's national economic policies and objectives. It then evaluates the Malaysian government's role towards promoting industrial and technological development. Chapter 4 includes a discussion on how the government views offsets as a mechanism for technology transfer. Chapter 5 offers an analysis of Malaysia's offsets policy, including issues related to the offsets strategy, process and implementation. This chapter uses the results of the empirical data analysis to evaluate the impact of offsets on technology development capability within the Malaysian defence industry. Further, the Malaysian defence industrial strategy, human resource development and R&D capability is also evaluated. The chapter discusses the benefits of offsets to Malaysia including job-creation, skills enhancement, dual-use technology, product/process innovation, inter-industry linkages, technology clusters, research and development and indigenisation. Finally, this chapter analyses the offsets cost as well as the challenges in realising a sustainable defence industry leading to *Malaysianisation.* Finally, Chapter 6 concludes that offsets have enjoyed mixed results in enhancing Malaysia's defence industrial and technological development, and offers policy recommendations geared toward crafting a more effective offset model for Malaysia.

References and Notes

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[2] The sudden increase in defence expenditure since 1999 was merely due to the increase in the US defence spending after the September 11 incident to combat '*war against terrorism'*. Otherwise, overall global defence spending has been on the decline.

[3] See Matthew Uttley, Defence Offsets, Weapon Proliferation and Emerging Security Challenges, *Defence Studies*, 1(1), spring 2001, 172-182.

[4] RMA occurs when new technologies are incorporated into a militarily significant number of systems which are then combined with innovative operational concepts and new organizational adaptations to produce quantum improvements in military effectiveness-see Ron Matthews and John Treddinick , Ed, *Managing the Revolution in Military Affairs*, (Palgrave, Basingstoke, 2001); See also Christopher Bellamy, What is Information Warfare, *In*: Ron Matthews and John Treddinick John, Ed, *Managing the Revolution in Military Affairs*, (Palgrave, Basingstoke, 2001), p.56.

[5] John Treddenick M, Financing the RMA, *In*: Ron Matthews and John Treddinick, Ed, *Managing the Revolution in Military Affairs*, (Palgrave, Basingstoke, 2001), p.97.

[6] This violates the principles of the WTO Agreement, which promotes free trade. Very small countries are signatories to the procurement agreement, which include Canada, Israel, Japan, Korea, Norway, and Switzerland. Article Sixteen of the Agreement says "Entities shall not, in the qualification and selection of potential suppliers, service providers, products and services, or in the evaluation of tenders and award of contracts, impose seek or consider offsets".

[7] Also see Ann R Markusen and Sean S Costigan, Eds, *Arming the Future: A Defence Industry for the 21st Century*, (Council on Foreign Relations Inc, New-York, 1999), p.78.

[8] US Department of Commerce, *Offsets in Defence Trade: Eleventh Report to Congres*s, [Online], (US Bureau of Industry and Security, 2007), (Accessed: 10 January 2007),
Available at: http:// www.bxa.doc.gov,

[9] Ibid, p.iv-x

[10] Ibid, p.v.

[11] Ibid, p.vi.

[12] Ibid, p.vi.

[13] Ibid, p.vii.

[14] Ron Matthews, 'Home Guard', *Financial Management*, June, 2003, 23; Offset is a commercial arrangement demanded by a buyer and agreed by a seller that obligate the seller to perform actions that will "offset" the outflow of money required by the contract for sale; See also Stephen Martin, *Economics of Offsets*, (Harwood Academic Publishers, Netherlands, 1996), p.31; Hall and Markowski, 'Some Lessons from the Australian Defence Offsets Experience' *Defence Analysis*, 12(3), 1996, 289-314.

[15] The Offset Management Offices of these countries have raised the difficulty of offsets implementation on many occasions such as the American Countertrade Association and SMI Conferences.

[16] Refer to the Epicos website for a list of offsets practising countries around the world. EPICOS, Country Offsets Policy, [online], (EPICOS, Athens, 2002), (Accessed: 11 June 2005), Available at: http://www.epicos.co.uk.

[17] See A O Hirshman, *The Strategy of Economic Development*, (Yale University Press, Clinton, M.A, 1958) for the poles of development argument on how defence production is meant to trigger "backward and forward linkages" to other industrial sectors.

[18] See J Brauer and J Paul Dunne, Saudi Arabia: Defence Offsets and Development in Arming the South, *In:* Jurgen Brauer, *The Economics of Military Expenditure*, *Arms Production and Arms Trade in Developing Countries*, (Palgrave, London, 2002); Martin S, Ed, *The Economics of Offsets: Defence Procurement Options for the 1990s*, (Harwood Press, Netherlands, 1996), p.54.

[19] See Ron Matthews, Home Guard, *Financial Management*, London, June, 2003, pp.11-13.

[20] Bernard Udis and Keith E Markus, US Offset Policy, *In*: Stephen Martin, the *Economics of Offsets: Defence Procurement and Countertrade*, (Harwood Academic Publishers, Netherlands, 1996), pp.357-360.

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[23] William Matthews, 'In U.S: A Battle to Outlaw Offsets', *DefenceNews*, May 24, 2004, 4.

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[33] Ron Matthews and Richard Williams, 'Technology Transfer: Examining Britain's Defence Industrial Participation Policy', *Journal of the Royal United Services Institute for Defence Studies*, 145(2), April 2000, 26-31.

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[55] Racial tensions reflected in the riots of May 1969 due to uneven income distribution and the economic power being controlled by the Chinese.

[56] The Free Trade Zones was introduced in the early 1970s to facilitate and encourage Malaysian manufacturing production for export mainly using imported equipment and material.

[57] This phase coincided with the New Economic Policy (NEP), introduced by the Malaysian government after the May 1969 post-election riots, under the leadership of Tun Razak ostensibly to create the socio economic conditions for improved inter-ethnic relations-and "national unity".

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[70]Ann Majchrzak, *Methods for Policy Research by Amitai Etizioni,* (Sage Publication, Newbury Park, 1984), pp.11-13.

[71] Ibid, p.12

[72] Basic policy research refers to traditional academic research done on fundamental social problems. It is more of theoretical nature and has little direct impact on policy decisions as well as action orientation is low.

[73] Policy analysis is basically a study of the policy making process. It is research where the researcher is interested in the process by which policies are adopted and the effects of those adopted policies. In such cases action orientation is low and the research questions are more technical in nature.

[74] T D Jicks, 'Mixing Qualitative and Quantitative Methods: Triangulation in Action', *Administrative Science Quarterly*, 24, 1979, 602-611; A.Tashakkori, and Teddlie, Eds, *Handbook of Mixed Methods in Social and Behavioural Research,* (Thousand Oaks, A: Sage, London, 2003).

[75] The mixed method refers to the usage of both quantitative and qualitative data collection techniques and analysis procedure. In contrast, multi-method refers to combination of more than one data collection technique but it is restricted within either quantitative or qualitative approach see A Tashakkori and Teddlie, Eds, *Handbook of Mixed Methods in Social and Behavioural Research*, (Thousand Oaks, Ca: Sage, London, 2003).

[76] Mark Saunders, Philip Lewis and Adrian Thornhill, *Research Methods for Business Students*, (Prentice Hall, Harlow, 1997) pp.145-146 identified four different possibilities for multiple methods. First, multi-method quantitative study uses quantitative data comprising questionnaire and structured observation analysing the data using statistical procedures. Multi-method qualitative study will use in-depth interviews and diary accounts and data will be analysed using non-numerical procedures. Mixed method research uses quantitative and qualitative data collection techniques and analysis procedures at the same time or one after another but does not combine them. Mixed model research combines quantitative and qualitative data collection techniques and analysis procedures as well as combining both the approaches at other phases of the research such as research question generation.

[77]Dan Remenyi, Brian William, Author Money and Ethne Swartz, *Doing Research in Business and Management*, (Sage Publication Ltd, London, 1993), pp.142-170.

[78] Smith and Heshusius, 'Closing Down the Conversation: The End of the Quantitative-Qualitative Debate Among Educational Enquirers', *Educational Researcher*, 1986, 15, 4-12.

[79]T S Kuhn, *The Structure of Scientific Revolutions*, 2nd Edn, (University of Chicago Press, Chicago, 1970).

[80] N K Denzin and Y S Lincoln, Eds, *Handbook of Qualitative Research*, (Thousand Oaks, CA: Sage, London, 1994), p.61.

[81]Alan Bryman, *Research Methods and Organisational Studies*, (Routledge, London, 1989).

[82] Ibid, p.42.

[83] Malaysia. Malaysia Industry Group for High Technology (MIGHT), *National Offsets Report*, (Prime Minister's Department, Putra Jaya, 2002).

[84] List of complete offsets programmes and beneficiaries since 1990 could not be obtained due to the lack of systematic record keeping within MOD, Malaysia.

[85] Data on the list of firms were obtained from the Malaysian Defence Industry Council webpage, consisting of the defence industry directory.

[86] Ministry of Defence, Malaysia, *Malaysian Defence Industry Council*, [Online], (Ministry of Defence, Kuala Lumpur, 2004), (Accessed 30 September 2004),
Available at: http:// www.mod.gov.my.

[87] Cooper and Schindler, *Business Research Methods*, (Irwin McGraw-Hill, New York, 1998).

[88] See C S Marshall, and G B Rossman, *Designing Qualitative Research*, 3rd Edn, (Thousand Oaks, CASage, 1999); U Sekaran, *Research Methods for Business: A Skill-Building Approach*, 4th Edn, (New York, Wiley, 2002). Both books discuss the importance of gaining permission for physical access, maintaining that access and being able to create sufficient scope to address fully the research question and objective that guide that work.

[89]M Esterby Smith, R Thorpe and A Lowe, *Management Research: An Introduction*, 2nd Edn, (Sage Publication, London, 2002).

[90] C Robson, *Real World Research*, 2nd Edn, (Blackwell, Oxford, 2002), pp.22-23.

[91] For further explanations of the different types of validity, see Alan Bryman and Emma Bell, *Business Research Methods*, (Oxford University Press, New York, 2003), pp.77-79.

[92] Ibid, p.35.

[93] P Wells, Ethics in Business and Management Research, *In*: V J Wass, and P E Wells, Eds, *Principles and Practice in Business and Management Research*, (Darthmouth, Aldershot, 1994), p.284.

[94] W G Zikmund, *Business Research Methods* 6th Edn, (Dryden Press, Fort Worth, TX, 2000).

Chapter 2

2. INDUSTRIAL AND TECHNOLOGICAL DEVELOPMENT IN DEVELOPING COUNTRIES

2.1 Introduction

Technology is a gift of God. After the gift of life it is perhaps the greatest of God's gifts. It is the mother of civilizations, of arts and of sciences.

Freeman Dyson[1]

The purpose of this chapter is to provide a critical review of the literature analysing the key theories concerning industrial and technological development. The literature review seeks to demonstrate three factors. Firstly, the availability of resources in fields related to research on development, industrialisation, technology and offsets. Second, this research tends to establish the limitations of literature on the subjects being analysed. Finally, this study seeks to demonstrate how offsets fits into the wider context.[2] Besides these three main factors, this literature review also provides the author with the opportunity to further refine the research questions and objectives, discover explicit recommendations from other literature, avoid work duplication, obtain up-to-date information about the subject studies, and finally, to discover research approaches, strategies and techniques useful to develop research questions and objectives.[3]

Technological and industrial development has become inseparable themes in the pursuit of economic progress in developed and emerging economies. Rapid industrialisation, sophisticated technological development and high levels of productivity are seen to be the source of both rapidly rising living standards and national prestige in the developed countries of Europe, the United States of America, and Japan.[4] The rapid phase of modernisation in the first world countries have inspired the developing world to join the 'industrial wagon',[5] seeking economic diversification to industrialise and *catch up* with industrialised nations. [6]

Table 2.1 shows the ratio of real incomes per head between the developed and the developing countries.[7] These figures portray the increasing gap between the two worlds. In an era of *globalisation of technology*[8] developing countries have two main reasons to worry: first, how to 'catch up' with the developed countries, which are aggressively exploiting and increasing their technological capability, and, second, how to ensure a sustainable and fair distribution of industrial and technological development.

Table 2.1: Ratio of Real Income per Head between Developed and Developing Countries

Time frame	**Ratio of Real Income Per head (Developing countries)**	**Ratio of Real Incomes Per head (Developed countries)**
19th century	3	1
1900	10	1
2000	60	1
2004	87	1

Source: Worldbank, *Country Report*, [online], (Worldbank, Washington, 2005), (Accessed: 11 January 2005), Avialable via: www.worldbank.org.

The importance of economic development to developing countries has led to a wealth of literature on industrialisation and technology transfer. The essence of much of the literature on technology transfer in the early stages drew empirically and theoretically from the many ways in which the market for foreign technology functioned, and these were normally not in the interest of developing countries. Problems included differences in technological innovation and diffusion, dependence, unequal sharing of the investment benefits, inappropriate foreign technology, absence of an autonomous and indigenous science system due to the absence of genuine transfer of technology; this latter factor was often because it was not in the interests of the technology supplier to lose an important source of monopolistic control. The literature also raises issues relating to the industrial and technological gap between the *have* and the *have-nots*, the lack of competitiveness and the struggle to maintain industrial sustainability. [9]

Much of development economic literature stresses the role of the state in assisting industrialisation and technological transfer. Government assists the transfer of technology via multiple modes, including foreign-direct investment, technical arrangement, bilateral cooperation and offsets. Offsets, mainly tied to arms procurement, have become a preferred mode of technology transfer for governments in developing countries. This is due to the leverage that purchasing countries possess in demanding technology and other economic compensation packages. Governments of developing countries heavily utilise offsets to enhance their defence industrial bases and improve military capability as well as promoting spill over-effects into the civil sector.

The literature in the offsets field is wide. The sources used and the framework presented in this chapter reflects the thrust and particular concerns underpinning the research. The chapter will initially define development and the need for industrialisation, with a particular focus on developing countries. It will then discuss the various industrialisation models and strategies. The task is to define technology, analyse the multiple issues related to technology and development, and evaluating the mechanisms for transferring technology. Finally, the chapter will evaluate the relevance of offsets as a mechanism for indigenisation, industrial competitiveness and sustainability in developing countries, with particular emphasis on Malaysia's defence industry.

2.2 Nuts and Bolts of Development

2.2.1 Development or Growth?

The study of development is multidimensional and multidisciplinary, ranging from the economic, political, societal and cultural. There has been a huge volume of literature written on development economics.[10] This field remains an interesting component for researchers due to the various political issues surrounding developing countries. This research will focus on the development and defence economics and the role of technology and industrialisation in the context of developing countries.

There is often confusion in distinguishing development and growth. The terms are often used interchangeably. Throughout this thesis, the term economic development is preferred to economic growth. Economic growth has a connotation of *quantitative* expansions in economic variables, especially aggregate and per capita national incomes as measured by such statistics as GNP. Therefore, economic growth is concerned with measuring growth in economic variables and identifying their relationships such as between national income growth and the speed of capital formation.

Economic development, on the other hand, is usually conceived as a process involving not only quantitative expansion but also changes in non-quantitative factors, such as institutions, organisations and culture under which economies operate.[11] Development economics is, to a greater extent than traditional economics or even political economy concerned with the political processes necessary for effecting rapid structural and institutional transformation of entire societies in a manner that will most efficiently bring the fruits of economic progress to the broadest segments of their populations.[12] The role of government in coordinating economic planning as well as broad based domestic and international economic policies is usually viewed as an essential component of development economics. Development economics seeks to address the needs of developing countries on issues such as poverty, famine, environment, technology gaps, education and health.[13]

Economic development aims to raise the overall development of a society. An adequate definition of economic development is not easy to construct. Todaro defined development economics as a more comprehensive discipline compared to economics and political economy.[14] He regards development economics as being concerned with the efficient allocation of existing scarce production resources, with sustained growth over time. Development economics must also deal with economic, social, political and institutional mechanisms, both public and private, necessary to bring about rapid and large scale impact on the levels of living for peoples in Africa, Asia, Latin America, and the former socialist countries.[15]

2.2.2 Nature of Developing Countries

Development terminology has become slippery over the past few years. Developing countries can no longer be categorised as a homogenous group of countries with relatively low levels of income per capita, with a strong specialisation in the production and exports of primary products. Various international organisations, such as the OECD, United Nation and the World Bank have their own classifications for developing countries.

Wide differences are taking place between groups of developing countries, as reflected in their levels of industrialisation,[16] the degree of export orientation of the manufacturing sector, and the contribution of manufacturing to total exports. This is due to differences in the availability of natural, human and capital resources and physical infrastructure facilities. The World Bank distinguishes developing countries based on their Gross National Product (GNP) per capita.[17] Based on this indicator, countries are divided into low, middle and upper-middle income groups. The middle-income countries are further divided into lower-middle and upper-middle income groups. The upper middle income group is further distinguished as the Newly Industrialised Countries (NICs) based on their levels of industrial and technological development. Malaysia, based on this classification falls under the special category of NICs amongst the upper-middle income country together with countries such as South Korea, Singapore and Taiwan.

2.3 Road to Industrialisation

2.3.1 Defining Industrialisation

The term ‘industrialisation’ is widely misunderstood. It does not simply refer to economic development,[18] but an outcome and indicator of economic development. The process of industrialisation forms the core of economic development for many developing countries. Various attempts have been made to define industrialisation. Tom Hewitt defines industrialisation as the production of all material goods not grown directly on the land.[19]

In simple terms, industrialisation is a process whereby economic development moves from an agricultural basis to industrial dominance and finally to a service industry focus. During the early stages of economic development, developing countries remain predominantly agricultural. In the post colonisation era, specialisation in agriculture and raw materials is identified with backwardness and industrialisation with increased economic activity, productivity and increased standards of living. As industrial development further matures, the production structure gradually progresses.[20]

According to Sutcliffe, based on the International Standard Industrial Classification (ISIC), revised in 1968, and shown in Table 2.2 below, he indicated that industrialised nations should have 60% of their industrial output in the manufacturing sector[21] and 10% of their populations employed in the industrial sector.[22] In the early 1970s, only Japan fulfilled these criteria in Asia. [23]

Table 2.2: ISIC Classification of Industrialisation

Division	Activity
Division 1	Mining and Quarrying
Division 2 &3	Manufacturing
Division 4	Construction
Division 5	Electricity, Gas and Sanitary

Source**:** R B Sutcliffe, *Industry and Underdevelopment*, Addison-Wesley Publishing Company, Oxford, 1971, pp.23-25.

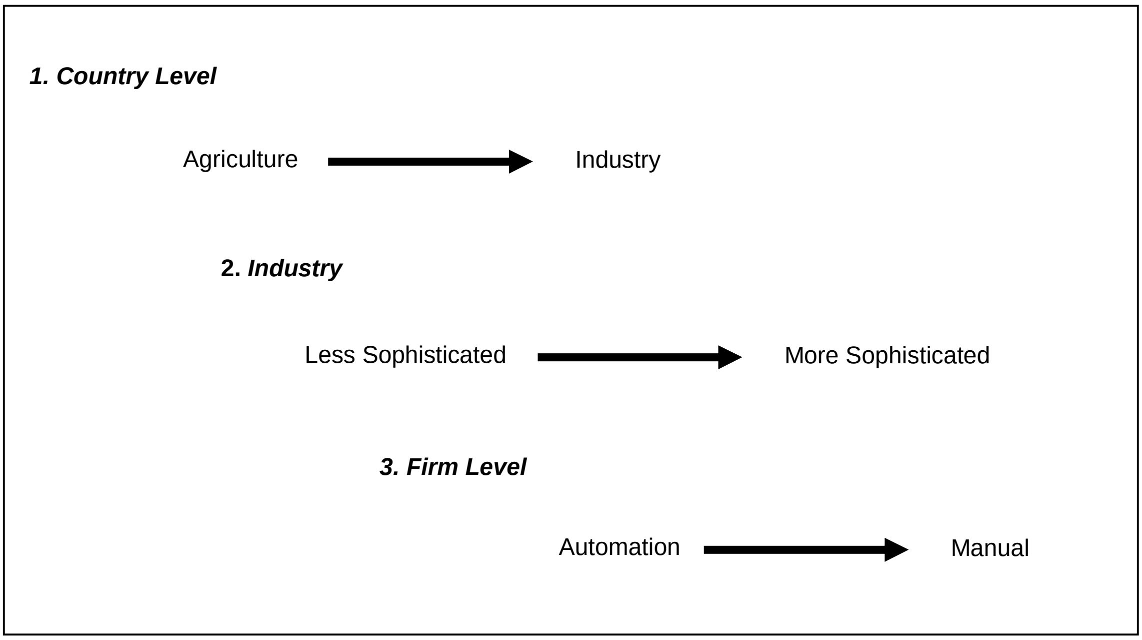
There are differing opinions on how industrialisation should progress in developing countries. The opponents of industrialisation, such as Myrdal and Elliott, argue against achieving development through industrialisation.[24] These observers view industrialisation as a new form of imperialism, neglecting the agricultural sector. Industrialisation is claimed to be overly dependent on foreign technology resulting in various drawbacks to developing countries. These include unemployment due to implementation of the wrong choice of technology, capital intensive industry in a labour intensive environment, environmental degradation, pollution and exploitation of rich against poor nations.[25] However, despite these arguments, industrialisation has continued to be dominant and has remained an important strategy for the economic development of underdeveloped countries.

Academics, such as Feber, Just and Zilberman, posit the view that underdeveloped countries must develop their agricultural sector first.[26] Development of the agricultural sector ensures stability of prices as well as social and economic stability. The superstructure of modern economic development, which involves the setting up of a wide range of industries, must be based on the firm foundation of agriculture. For this purpose, it would be appropriate for developing countries to concentrate resources initially on the development of the agricultural sector and other simple industrial activities, which do not absorb much capital. But once a reasonable supply of food and other wage goods is assured, countries can then allocate resources for the development of the modern industrial sector, ensuring self-sustained economic growth.[27]

However, this view was dismissed by some development economists, such as Sutcliffe, arguing that developing countries should focus on the manufacturing sector[28] due to its productivity growth and technological development.[29] The manufacturing and service industries have become key components of industrialisation in some developing countries. In the 1970s and 1980s, countries in Asia, such as Taiwan, South Korea and Singapore, and in Latin America, such as Brazil, have greatly accelerated the growth of manufacturing outputs and as a consequence have rapidly industrialised.[30] Despite arguments that this model of development is defective due to high dependency on export markets, reliance on MNCs for capital-intensive foreign technologies, creating little value-added employment, the track record of economic growth in these countries has proven to the contrary. Besides China, GDP growth of the NICs has been one of the highest and fastest in the world. Several pull factors, such as independence from colonial power, unemployment due to the stagnation of the agricultural sector, investments from MNCs subject to state control and imported technology, have helped these countries 'leap frog' industrial stages, enhancing technological development.[31]

Industrialisation can occur at three different levels: the country, industry and firm level. Figure 2.1 shows that at the country level, the industrial shift is from agriculture to industry, with respect to output and labour. At the industry level, the shift is from less sophisticated technology to more sophisticated technology of product, process, know-how and management. Finally, at the firm level, the shift is from low level labour intensive work to high level capital intensive and high technology related work. This shift in the industrialisation process may increase productivity, income per capita, employment and growth in other sectors of the economy through backward and forward linkages.

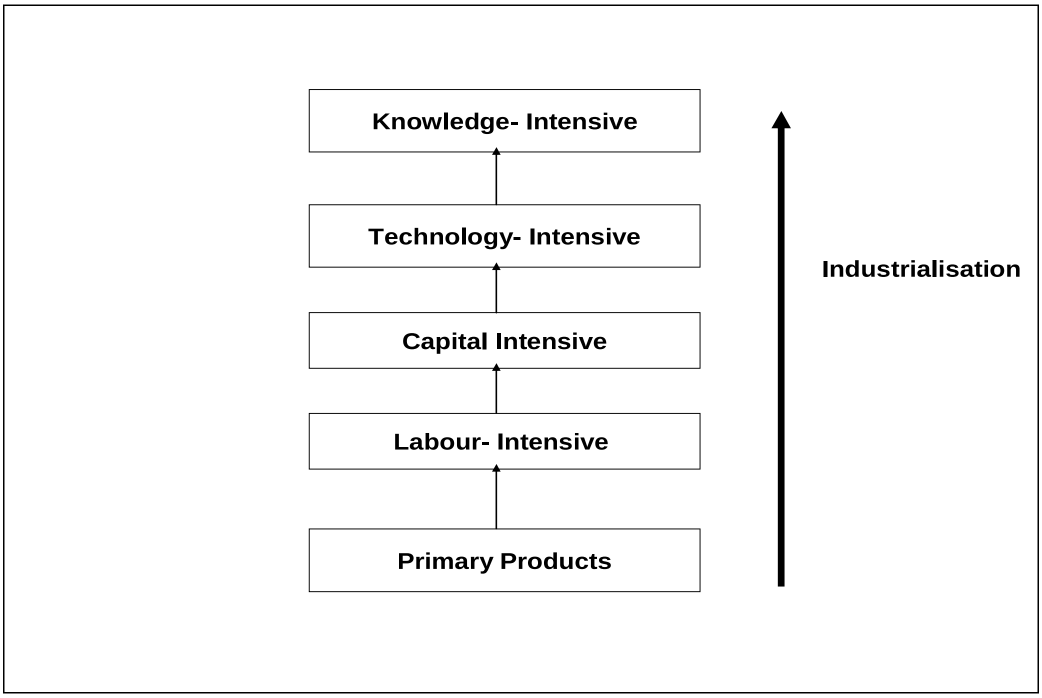
Figure 2.1: Three levels of Industrialisation



Source: Ashish Kumar, *The Impact of Policy on Firms' Performance: The Case of CNC machine Tool Industry in India*, PhD Thesis, Van Wageningen Universiteit, the Netherlands, 2003.

The present study focuses on the shift of industrialisation process at all three levels being country, industry and firm level. At the initial stages of industrialisation, there will be an increase in manufacturing in terms of total output and share of employment in manufacturing within total employment. As manufacturing activity progresses further, there will be higher value added activities with an increase in the technology absorption level, including investment, infrastructure development, skills enhancement and management processes. Figure 2.2 depicts how a nation's initial manufacturing process starts with the processing of raw materials and commodities requiring only low-tech, labour intensive inputs. The comparative advantage at this stage is based on natural resources and low costs of labour. When a country starts producing intermediate products, more labour intensive and capital intensive activities are undertaken. There is a gradual reallocation of labour from primary products to intermediate types of products. Division of labour at this point results in increased specialisation and production and higher use of intermediate products. During this stage, comparative advantage depends on sustained investments, adaptation and assimilation of technology such as the ability to learn. At the advanced stages of industrialisation, such as in the defence and aerospace industry, where technology intensive and knowledge intensive activities are undertaken, the need is for high levels of investment, technology, management skills, technical skills and know-how. Comparative advantage at this level depends on a firm's ability to absorb, adapt, improve and innovate.[32]

Figure 2.2: Structural Shift at the Industrial Level



Source: Author

There are generally three different models of industrialisation. First is the capitalist model, adopted by a majority of countries in the world. Firms rather than governments do the planning. Countries such as Britain, Japan and the United States, with open economies, follow this model. Second is the socialist model. Eastern European countries, such as Russia, Poland and Ukraine pursued industrialisation under the socialist system. With a closed economy, the industrialisation process was hampered by their involvement in the closed economic system. The industrial planning of these economies was solely done by government.[33] The third model is the 'late' industrialising model, which can be further divided into two tiers. The first tier consists of countries like Hong Kong, Singapore, South Korea and Taiwan. These 'newly industrialising countries' have promoted strong 'export-push strategies' by utilising existing technologies with labour intensive products and then progressing quickly to more complex products that were capital and technology intensive.[34] These countries realise that rapid industrialisation was crucial for raising the standards of living. Hong Kong,[35] South Korea and Taiwan had strong support from their governments to build up the international competitiveness of domestic industry, eventually raising living standards.

The second tier consists of Malaysia, Indonesia, and Thailand. These countries have been reliant on selective government intervention to promote industrialisation. However, these second tier countries faced (and, indeed, face) constraints in their industrialisation strategy, including the small initial size of the domestic market, weaknesses of the national industrial entrepreneurial community, the lack of managerial expertise, limited technological capacity and international marketing networks.

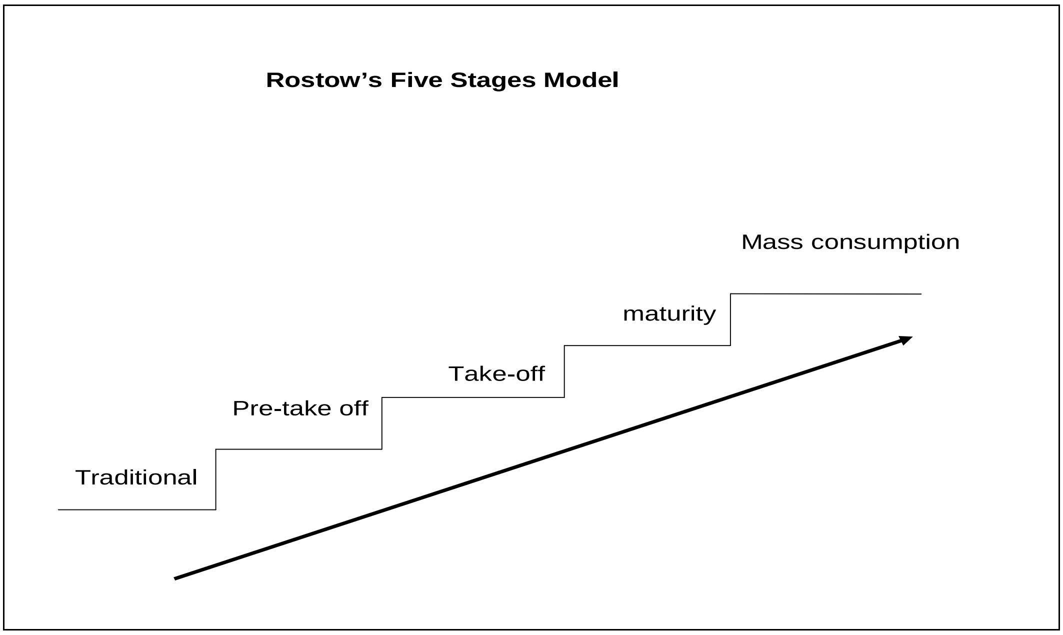
2.4 Why Do Developing Countries Need to Industrialise?

The question as to why countries need to industrialise has been debated at length at many international forums. Adam Smith through his 1776 treatise 'An Inquiry into the Nature and Causes of the Wealth of Nations', viewed industrialisation and trade liberalisation as the driving force for economic growth. Since then, different schools of thought have expressed views on the need to industrialise. Post-World War II literature on economic development has been dominated by four competing strands of thought establishing the need for industrialisation and technological development, namely: the 'linear stages of growth' model; theories and patterns of structural change; the international dependency revolution; and neo-classical/neo-liberal theory.[36] These theoretical frameworks offer an understanding of the stages of economic growth that led to industrialisation, the role of the state in promoting structural growth and industrial development, and the politico-economic need for developing countries to be self-reliant.

2.4.1 Linear Stages of Growth Model (LSG)

Advocates of the LSG model, in the 1950s and 1960s, viewed development as a series of sequential stages of economic growth that all countries must pass through. W.W Rostow identified the five stages as per Figure 2.3, as the traditional society; pre-take-off; take–off; drive to maturity, and the age of mass consumption.[37]

Figure 2.3: Rostow's Five Stages Model



Source: W Rostow W.W, *The Stages of Economic Growth, A Non Communist Manifesto*, Cambridge University Press, Cambridge, 1960.

Rostow explained that at the traditional society stage, production techniques are largely primitive, based on pre-Newtonian science and technology attitudes towards the physical world, with most people engaged in agricultural and related work with power vested in landownership.[38] Next, the pre-take-off stage is associated with the ideas and processes initiated for changes from the old culture to a modern alternative. Rostow quoted the example of Western Europe in the late seventeenth and early eighteenth centuries, where medieval societies disintegrated, modern society grew, and trade developed. This was also the era when the possibilities for production were opened-up through modern science. The third stage, the 'take off', is viewed as the most important period amongst all the stages, when all the '*old blocks and resistances to steady growth are finally overcome' and when 'compound interest becomes built, as it were, into [society's] habits and institutional structure'.*[39] During this stage, there is a rapid increase of economic activity fuelled by equally sudden spurts of savings, investments and radical technological change. A new entrepreneurial class emerges, agricultural productivity improves and resources, including population, begin to move into industrial activities located in towns.[40] At the fourth stage, industries become mature. Rostow claims that during this period, nations will invest 10-20% of their national income towards new production capacity. Industries will forge ahead, mature and level-off whilst new industries will arrive on the scene. This era witnesses a mature economy and society, resting on the absorption of home-generated technologies.[41] Finally, in the age of mass consumption, nations reach a level where their economic system is able to produce a surplus.[42] At this juncture, leading sectors of a nation shift from heavy industries towards consumer durables and services. [43]

Developing countries are said to take on similar stages of economic growth. These countries are primarily agricultural-based and backward in terms of culture, political systems, social institutions and economic resources.[44] The possible solution is to borrow, buy or copy those capitalist features of the rich countries felt to be instrumental in bringing about economic growth. They need to undertake a transition to become developed. The right quantity and mixture of savings, investments and foreign aid are all necessary to enable developing nations to proceed along an economic growth path that had historically been followed by the more developed western countries (e.g. Britain and the United States).[45] It is felt that developing countries have the advantage of being late-comers and so avoiding the mistakes made by the now developed countries. However, a total application of the LSG model to developing countries by Rostow was refuted by some scholars such as Myrdal, Myint and John.

Other schools of development heavily criticized the stage model. For instance, there can be no one path to industrialisation for all countries as development is influenced by various factors such as historical background, economic resources, political climate, government policies and infrastructure.[46] LSG was said to be unrealistic and Eurocentric.[47] There was also an absence of discussion on issues such as the type of institutional and policy changes necessary in developing countries. Additionally, there are likely to be traits that should not be emulated by the developing countries.[48] Contemporary economists such as Nash,[49] Roxborough[50] and Apter[51] have attempted to reconstruct the linear stage model. Apter, for instance, argued that modernisation approaches could produce a coherent result for developing countries.[52] The unpopularity of the LSG model in developing countries gave rise to the structuralist model.

2.4.2 The Structuralist Model

The structuralist model was developed by a range of writers from Latin America, amongt them being Raul Prebisch.[53] Before this model flourished, Latin America, in the years before the great depression of the 1930s pursued policies of primary-product exporting. International trade at that time was based on the Ricardian Theory of comparative advantage,[54] structuralist felt to be ineffective for developing countries.[55] This is because products exported by poor countries, mainly food and raw materials, face greater falls in prices during periods of economic instability thereby benefiting consumers mainly located in rich countries.[56] The Ricardian theory, however, guaranteed industrial prowess for the Western economy and relegated the rest of the world to the status of raw material suppliers. The demand for raw materials fell drastically during the great depression as did the income for Latin America. This was the era when changes were initiated by governments of Latin America to adapt to these adverse circumstances.

Prebish disputed the Ricardian economic theory that international specialisation conferred benefits upon all nations. He instead advocated the centre-periphery idea, where developing economies are categorised as the periphery with a secondary and declining position as primary product producers, while developed countries enjoying rapid industrialisation are located at the centre. Structuralists argue that the terms of international trade benefitted the rich at the expense of the poorer nations.[57] Prebish's initial argument was based on the fact that most of the developing countries exported primary commodities to the rich countries, which in turn sold manufactured products made out of the same commodities back to the developing nations. He argues that the 'value added' from manufactured products will definitely be higher than that for raw commodities, thus creating less earnings for the developing countries.[58] The different roles assigned to primary exports and industrial exports by the international division of labour, results in an unequal distribution of technical progress. The core economies tend to achieve an even greater technological lead, thus securing dominance.

The structuralist school attempted to use modern economic theory to reflect the internal process of structural change that a 'typical' developing country must undergo if it is to succeed in sustaining a process of rapid economic growth. A stucturalist economic theory was formulated to model local economies so that governments could effectively plan for national development. Accordingly, Prebish called for the pursuance of national programmes of industrialisation behind tariff barriers.[59] He suggested that developing countries must undergo structural change to generate and sustain economic growth.[60] Raul Prebisch later suggested that developing countries should embark on ISI strategies to overcome economic underperformance.

However, this policy backfired when the dependency group later focused on the failure of import substitution strategy (ISI) to create an independent national economy, allowing transnational corporations to take over most of the dynamic sectors of the economy. The developing world was seen as a source of cheap labour and the location of capital-intensive assembly plants, without first-world research and development activities in place. The high rates of growth in East Asia based on the exports of manufactured goods to the first world were dismissed as in no way significantly different from the old raw materials export-led growth model, which caused third world underdevelopment in the first place.[61]

Structuralists have also been concerned with technological dependence arising out of excessive reliance on imported technology. Firms in developed countries were felt to be providing inappropriate third-generation technology at excessively high prices. The technologies developed in Western countries may be inappropriate for conditions in developing countries, in that they may be too capital-intensive for the labour market or too large scale for the small markets of many developing countries, creating unused capacity. There is also a lack of local technological capability within the developing world.[62] This weakens the bargaining power of firms in negotiating to acquire imported technology, limiting their ability to adapt the imported technology to local conditions. When countries import a technology package through a TNC, where all the principal elements are provided from abroad, there are no opportunities for local learning. Nevertheless, due to the lack of alternative sources and in order to gain competitive advantage locally, Third world buyers choose to pay extra for these technologies. These factors create a strong urge for the industrialisation of developing countries to be self-reliant, building their own technological capability at an early stage of development.[63]

Many of the countries adopting this model have pursued an import substitution industrialisation (ISI) strategy in line with the Keynesian economic model, structuralists believe that government should play an important role towards industrialisation in developing countries.[64] Government should, through the ‘infant industry’ protectionist model, protect local industries through trade barriers, tariffs and other protection mechanisms.[65] However, structuralism fell out of favour as the drive to enhance industrialisation faltered. Political interference, lack of infrastructural support, large investments, the inability to cope with increasingly complex technology, made many countries such as Brazil, Argentina, Mexico and Indonesia abandon this model and look towards an outward industrialisation model.

2.4.3 Dependency Theory

Contrary to neoclassical theory, which had assumed that economic growth was beneficial to all and has been distributed along the value-chain (pareto optimal), the *dependencia* group were not convinced that economic development in the developed countries has necessarily trickled down to the developing world. The dependency theory deals directly and explicitly with the issue of underdevelopment, and developing countries pursuing the ambition of attaining self-reliance. Dependency theory argues that poverty and underdevelopment are caused by the negative influences of advanced countries.[66] Underdevelopment is blamed on imperialism, colonialism and western capitalism. Imperialism has drained the colonies of resources that could have been used for investment and killed off local capitalism through competition.[67]

Surpluses produced at the periphery were extracted and expropriated by the centre.[68] There is continuous reference in the literature to this scenario where the developed countries tend to impoverish the developing countries through ‘backwash effects’, ‘low level equilibrium traps’, backward sloping supply curves, ‘critical minimum efforts’, all of which tend to impact negatively on the future possibilities for developing countries.[69] Early versions of the dependency theory were inclined to claim that Third world countries would remain locked into ‘classical dependence’, producing primary goods and importing finished goods. These versions did not see the change in production structure called for by the structuralists, namely industrial development. Industrialisation in the developing countries was claimed not to be genuine and highly dependent on the advanced capitalist world.[70] Developing countries were claimed to be looped in a ‘vicious cycle’ of dependence on foreign sources of technology for industrial development.

Preston identified three core features of dependency: (a) the importance of considering both the historical experience of peripheral countries and the phases of involvement with wider encompassing systems; (b) the necessity of identifying the specific economic, political and cultural linkages of centres and peripheries; and (c) the requirement for active state involvement in the pursuit of development. Unlike modernisation theory that describes the smooth transition of the underdeveloped countries from traditional to modern phases; the dependencia model offers a story of how the peripheral countries fitted into the expanding sphere of the capitalistic core creating a series of asymmetrical relationships between the periphery and core. The dependencia theory called for attention on a wider political-economy, within which particular nation states operated. The experiences of the peripheral countries were to be found in a pattern of economic, social and cultural linkages with the more powerful core countries. As opposed to the modernisation theory that emphasised the market place, the dependency group wanted an independent pattern of development. The state was to become a key vehicle in the development project. Furtado also mentioned the key role of the state in political reform strategy. [71]

Nevertheless, dependency theory has been criticized for being vague.[72] For example, Lall argues that countries like Canada and Belgium are more dependent on foreign investment than India or Pakistan, but they are not underdeveloped. [73] The dependency theory stressed the notion of self-reliance and how states should free themselves from being dependent on foreign sources for technology.

2.4.4 The Post Washington Consensus (PWC)

The 1980s and 1990s brought a new dimension to developmental economics in the form of ‘new development economics’. The Washington Consensus emphasises the stabilisation of the economy through control of the money supply and enhancement of growth through supply-side measures aimed at boosting private sector activity, such as privatisation.[74] However this group emphasised the benefits and role of free market enterprise, open-economics and the privatisation of inefficient public enterprises and export-oriented industrialisation.[75] This group claims that industrial growth failure is not due to exploitative external and internal forces but rather due to too much government intervention and regulation. Neo-liberal academia argued that the market left to its own devices is a far more efficient arbiter of economic development.[76]

According to the Washington model, competitiveness is eroded due to too much government intervention and poor resource allocation, such as incorrect pricing policies, high tariff rates, trade barriers and too much local industry protection. Neo-liberals prefer to rely on the market to choose the technology most appropriate for a given industry in a given country as they view technology as a 'black box.'[77] Neo-liberalists argue that technology is an important variable in the cost calculation, recommending that developing countries should use tried and tested technologies to keep the initial investment cost low.[78]

The Washington Consensus group believed that technology development and industrialisation are best nurtured by creating a correct set of incentives by 'getting prices right'. They provided little room for intervention policy. The reforms argue for removal of state-induced policies such as privatisation, price controls, discretionary taxes and subsidies. Any market-based resource allocation policy was seen as distortionary. It was assumed that laissez-faire industrial policy would result in optimal allocation of resources for technology development. Any reference to tacit knowledge asymmetry as being disadvantageous to technological development, were completely ignored. The group mainly viewed the positive effects, dismissing the constraints due to limitations on the supply side. However, the Washington consensus was undermined by the failure of the free market system in many of the developing countries. Many of these developing countries did not have the structural adjustment capability or the potential for additional investments and high quality bureaucrats.

A Report by the Overseas Economic Cooperation Fund (OECF) to understand the economic miracle of East Asian countries mentioned that for East Asian developing countries, such as South Korea, Taiwan and Singapore, the dominant approach was to emphasise market forces and the need to take advantage of international market opportunities.[79] However, the government's role was seen as providing a suitable environment within which private initiative can flourish. The Report highlighted that in these countries; the government intervened to foster development and in some cases the development of specific industries. The Report also showed that in the NIC countries, government intervention actually increased growth which otherwise would not have occurred. Based on these arguments, the Post Washington Consensus (PWC) group called for government intervention.[80] However, government intervention in this case does not imply the old style of intervention. The PWC consensus discusses transformation of society including issues of sustainability, equity and democracy. It talks about how the public-private partnership, arm's length government approach and smart partnership' with industry was promoted to assure competitive and sustainable industry. [81]

PWC argues that the market mechanism alone cannot create technology development.[82] The market is influenced by other features, such as the tacit and imperfect nature of technological knowledge and informational asymmetries. PWC group argue for selective government intervention through industrial policy, strategic interventions in trade and the creation of dynamic national innovation systems. Selective industrial policies are required to identify and promote specific sectors as well as to increase investment in technology generation.[83]

2.5 Industrialisation Strategies of Developing Countries

The role of government is necessary to make strategic choices with respect to industrialisation in developing countries. Even countries such as the UK and US, which are today champions of free trade and free market policies, were strongly dependent on government support in their early stages of industrialisation.[84] In developing countries, government often intervenes in areas such as the investment of scarce resources and the types and scale of technology to encourage industrialisation. Governments may carry out their strategies through Industrial Master Plans. The following section will discuss some of the industrial stratgies of developing countries.

Developing countries evolve from a purely agricultural base in the early stages towards import substitution industrialisation (ISI) and some of them opt for an export-oriented industrialisation (EOI) strategy. Many of these countries themselves go on to employ both the ISI and EOI strategies for the best industrial outcome. For example, Chenery, as per Table 2.3, classified development strategies into four categories, namely, primary specialisation, mainly concentrated on agriculture with minimal industrialisation; exclusively import substitution industrialisation; EOI and ISIs as well as Exclusive Production Zones; with EOI and ISI, with a more dominating EOI.[85] However, this classification proved not to be stationary, changing over time. For instance, Malaysia, which was classified as having primary specialisation in the 1960s and 1970s, is today a country specialising in industrial production.

Table 2.3: Development Strategies

Colonial production 1400-1945	**Early Post-Colonial Policies 1950-1960s**	**1970-1990s reforms**	**Projected Policies**
Agricultural and minimum industrialisation	exclusively import substitution industrialisation	Import-substitution and export production to export-oriented (EOI) and EPZs	Combination of EOI and ISI with a more dominating EOI

Source: Chenery H B and Syrquin M, *Patterns of Development, 1950-1970*, Oxford University Press, New York, 1975.

2.5.1 Import Substitution Industrialisation

ISI was introduced in the 1930s into Latin America, in the 1940s into late-industrialising countries, and in the 1950s into other parts of the developing world, particularly into the NIC countries, such as South Korea and Singapore. ISI was employed by the developing countries to replace selected exports with local production.[86]

The literature on ISI argues that it was introduced in the developing countries for various reasons, including self-reliance, building indigenous technological capability and diversification to capture export markets. The State was identified as a major player in the ISI stage. Governments provided the impetus for industrial development through incentives, such as developing infrastructure, offering tax holidays, protecting domestic industry through infant industry protection policies and imposing indirect mechanisms such as State subsidies.[87] In some countries, OEMs played an important role by assisting through partnership or joint venture.

The ISI industries, focusing largely on assembly processes, relied heavily on imported materials and components, these having to be purchased from industrialised countries. This created a heavy reliance on imported inputs and foreign managers. Most importantly, the domestic industries lost competitiveness and innovativeness due to limited technological capability as a result of government protectionism and a less experienced management and workforce.[88] Firms were less motivated to seek newer and more efficient technology or adapt it to local needs. Lack of competition created inefficient firms in terms of production quality, productivity and price. Capital-intensive modern technology failed to create the appropriate jobs for locals, limiting the growth of the domestic market. It was also felt that ISI strategy undermined agricultural development.[89] Meanwhile, extensive government intervention led to corruption and 'rent-seeking' on a significant scale.[90] Countries like Chile, Pakistan and Ghana failed miserably in the 1960s due to the implementation of the ISI policy.[91]

According to Chenery:

Over time these policies led to ……… relatively low levels of exports, diversion of resources from agriculture, and ultimately a slowdown in the growth of industry and Gross National Product (GNP) as the possibilities for import substitution were progressively exhausted. Because of this market limit, the strategy of inward-looking development usually succeeds in eliminating the specialization in primary production but not achieving manufactured exports.[92]

Neo-liberals viewed the ISI strategy as economically inefficient due to the promotion of inefficient and high cost industries. Most of these industries based on heavy goods production take a long lead-time for tangible returns on investments.[93] In the early 1960s, several developing countries such as Argentina, Brazil, Columbia and Mexico began to abandon the idea of *import substitution at all cost.*[94] A new approach called export-oriented industrialisation became the way forward for these countries.[95]

2.5.2 Export Oriented Industrialisation (EOI)

Multinationals have mainly been responsible for the promotion of EOI into developing countries. Locational factors, disciplined unskilled labour at low wages, adequate infrastructure, and stimulative government policies with tax incentives as well as EPZs offer a favourable investment climate attracting MNCs into the manufacturing sectors. EOI have become popular amongst the East and the South East Asian members. These countries were attracted to the EOI strategy due to the unavailability of economies of scale, encouraging foreign investment to spur the economy. Competitiveness is crucial; otherwise EOI countries will suffer negative consequences.[96] Some of the most successful developing countries, including Taiwan, South Korea and Singapore have achieved extraordinary industrial growth by using an outward-oriented model driven by market incentives and a strong private sector. For example, Table 2.4 illustrates GDP growth of selected countries engaging in an EOI strategy.

However, the literature criticises an EOI strategy for its limited contribution to both the creation of a skilled labour force and technological development.[97] Production in developing countries is mainly a simple assembly activity that is process-specific and routine-like by nature. Possibilities for upgrading and shifting comparative advantage towards more skilled and semi-skilled sectors are considered to be limited. The pattern of specialisation that results from an EOI strategy is claimed to be at the lower end of the technology spectrum.[98] Countries with EOI strategies have a weak domestic economic and technological base and a high degree of dependence on external factors.[99]

Table 2.4: GDP Growth for Countries implementing EOI strategy (Fourth Quarter of 2004)

Country	GDP growth (%)
Hong Kong	**7.2**
Indonesia	**5.0**
Malaysia	**6.8**
Singapore	**5.4**
South Korea	**4.6**
Taiwan	**5.3**
Thailand	**6.0**
Brazil	**6.1**
Mexico	**4.4**

Source: ‘Emerging Market Indicators’, *Economist*, 15-21 January 2005, p.102

2.6 Industrial Clusters

A cluster is defined as a 'geographic concentration of competing and cooperating companies, suppliers, services and associated institutions.[100] Industry tends to cluster geographically due to the need to exchange information, transmission of tacit knowledge about business formation and product development, localised concentration of skilled labour, lifestyle amenities, and research facilities associated with research universities, large corporations and research labs.[101] Industrial clustering has been identified as an effective way to nurture small and medium size enterprises in developing and developed countries so that they survive and stay competitive on a regional, international and global level.[102] Clusters can increase the quality of local suppliers, focusing on specialised local research and training providers. Clusters have been found to increase the productivity of firms through specialised access to suppliers, stimulating new business formations that support innovation.

MNCs relocate their value chains in to specific clustered areas to leverage the potential and capabilities that clusters can offer.[103] There is evidence that firms locate to one geographic area to improve their comparative and competitive advantages.[104] Localisation of firms in the same area affords firm geographic proximity, thus encouraging the development of highly skilled workers for the specific needs of a particular industry. Firms in need of this skill will have easy access to it. These firms can experience economies of scale in developing and using common technologies, tending to promote a maximum flow of information and ideas. Products, markets and technological knowledge can be easily shared and effectively turned into valuable innovations. These factors, together, contribute towards industrial competitiveness. Information technology clusters, such as in Bangalore and Singapore, have been extremely successful in producing globally competitive IT firms. Countries such as Malaysia and Thailand have followed similar routes to developing industrial clusters to prop-up their SMEs. Despite the success and unique competitive advantages that industrial clusters possess, it is important for firms seeking global competitiveness to identify the critical factors that make clusters successful.[105]

2.7 Technology and Development

Technology, an integral ingredient of industrialisation, is a crucial factor in propelling economic development. Rapid technical transformation accelerated by globalisation requires technology to be the central focus for competitive and sustainable industrialisation in developing countries. The nature, magnitude and mode of technology transfer into developing countries have been influenced by various factors such as geopolitical conditions, culture, economic conditions, ideology, production possibilities, research and development policies and profitability. These factors are also highly influential in determining the effectiveness of the transfer process. The following section will provide an overview of the definition, transfer process, technology paradigm and the various mechanisms for the transfer of technology.

2.7.1 Defining Technology

Having established the importance of technology transfer for industrialisation and economic development, it is vital to define the term technology. Defining technology is not a straightforward exercise. Definitions of technology can be drawn from multiple disciplines, each with its own idiosyncrasies to suit the characteristics of that particular discipline. Various definitions of technology are shown in Table 2.5. Although the definitions appear to be distinct, there are similar features between the separate definitions.[106] This study, attempts to define technology from a management of technology transfer perspective. Technology from a management perspective considers technology as a complete package, including both soft and hard technology involving the production, processing, and finally commercialisation of the product.

Based on these definitions, the distinctive elements of technology include:

i. Process technology.
ii. Product technology.
iii. Method.
iv. Techniques.
v. Human skills.

vi. Management techniques.
vii. Industry structure (suppliers, users, promoters).
viii. Commercialisation.

McIntyer focuses on soft technology, which he defines as a process in which knowledge is used to reduce uncertainty and achieve the desired end.[107] It is a process for creating solutions to problems. Meier supports this view whereby he defines technology as 'technical knowledge' reflecting on the intellectual conception of the possibilities to combine factor inputs such as labour, raw materials, machinery, and others, to achieve an output of products, defined in terms of quality and quantity.[108] Technical knowledge includes not only the engineering aspects of production, but also the economic and organisational aspects of firm operations, including management and marketing activities, and the full combination of skills and knowledge. The technological infrastructure necessary to support the recipient country includes the required hardware, the level of technological education, the technical level of process technologies in the receiving firms, the capability to perform R&D work and the ability

Table 2.5: Definitions of Technology

General: Dictionary definitions:

Webster's Dictionary (2001)

1. The science or study of the practical industrial arts
2. The terms used in a science, technical terminology
3. Applied science. In simple terms, the definitions stress on the study and application of science.[109]

Collins Dictionary (1991)

1. The application of practical or mechanical sciences to industry or commerce
2. The methods, theory and practice governing such application
3. The total knowledge and skills available to any human society[110]

Oxford Dictionary (2000)

Science or industrial art; literally, the science of technique is systematic knowledge of technique. Technique: the interaction of people/tools with machine/objects which defines 'a way of doing' a particular task [111]

Management of technology transfer:

Abetti:

Technology as a body of knowledge, tools and techniques, derived from science and practical experiences that is used in the development, design, production and application of innovations as well as new processes or methods by which outputs are generated.[112]

Baranson:

Gives a similar definition of technology as consisting of product designs, production techniques and managerial systems to organise and carry out production plans.[113]

Goulet:

Specifies the results of the application as asserting control over nature and over human processes of all kinds.[114]

Meissner:

Goes one step further by defining technology as the configuration of processes, plans, techniques, knowledge and skills and that the configuration of this structure is to effectively produce, process and market a product or service. [115]

Djeflat:

Technology marketed as a complete entity: all technological components tied together and transferred as a whole: capital goods/ materials/know-how/qualified and specialised manpower[116] to maintain the given technology. Technology is meaningless without 'know-how' and the local ability to repair, design and produce technology.

Know-how often cannot be captured in words.[117] Sahar supports this view where he claims that simply focusing on the product is not sufficient to studying the transfer and diffusion of technology. According to Sahar, it is not merely the product that is being transferred but also the knowledge of its use and application.[118] The United Nations Conference on Trade and Development (UNCTAD) attempted to provide a comprehensive definition of technology comprising both hard and soft technology, whereby technology is said to be:

….. an essential input to production, is bought and sold as capital goods, human labour and information of a technical and commercial character. The elements of technology include feasibility studies, market surveys and other pre-investment services; determination of the range of technologies and choice of technology; industrial processes; engineering designs and detailed engineering; plant construction and installation; training of technical and managerial personnel; management and operation of production facilities; marketing information and improvements to processes and product designs.[119]

Molas Gallart also takes a comprehensive view of technology, defining it as capital equipment, software, scientific and technical knowledge, skills, research and production processes, designs, blueprints, management techniques and principles, and the resulting products developed to solve technical problems.[120] Based on these definitions, the present study considers both the 'soft' and 'hard' technology component as vital in the transfer process. Hard technology is confined to the material aspects of the technology such as jigs, tools, machines and equipments that are used in the production process. Soft technology includes knowledge, manuals, management, work organisation and marketing.

2.7.2 Innovation versus Invention

It is important to distinguish between *innovation and invention* when defining technology. Most literature has focused on differentiating these two terminologies. Freeman mentions invention as an idea, sketch or a model for a new improved device, product, process or system.[121] Inventions are economically irrelevant if they are not carried into practice. Innovation, on the other hand involves new product, process, system or device. Innovation is the whole process from idea to finished product, while technology transfer is one of the means of achieving innovation. Technology transfer can be said to be a subset of the process of innovation.[122] Innovations can be subject to continuous adaptations and improvements, which can later be an important source of productivity growth compared to the original innovation itself.[123]

Two types of innovation have been identified, namely: product and process innovation. Product innovations are often associated with discoveries of new technologies due to new demands. In contrast, process innovations often take place under conditions of economic stress where the action is to cut production costs of a given product to cope with the market demand.[124] Developing countries are said to indulge in process innovation rather than product innovation due to the lack of capital and human resources. The present study addresses the transfer of technology, in both hard and soft technology, focusing on product and process innovation. Having defined technology and noted the difference between innovation and invention, it is also vital to define several specific types of technology, dual-use technology and high technology.

2.7.3 Dual-Use Technology

Dual-use refers to products and technologies that have both civil and military purposes, such as computers, chemicals and advanced telecommunications, encryption, radar and laser technologies. Dual-use items which are used in one area of activity can be adapted and used in others. Dual-use technology has today become a strategic technology development choice amongst some developing countries. Dual-use products can be applicable to defence and civil uses without any modifications.[125] For example, the origins of commercial technologies today could be traced to defence-funded sectors, such as civil aerospace. The strong commercial market has been utilised to sustain R&D investments as compared to the complex military procurement procedures.[126] The influence of commercial activities could also include procurement reform, conversion and diversification strategies.[127]

Dual-use activities can be output or input oriented. Output relates to output of the research or production activities. In this study, output, relates to the type of technology transferred through offsets. This output can produce dual-use products applicable to defence and civil use without modifications, such as general purpose computers, electronics or dual-use products that need adaptation, such as radar, numeric control machines, transport containers and microwave ovens. Many military systems are not dual-use as they cannot be adapted to carry-out a task other than the specific job for which they have been designed.[128] However, the sub-systems and components are generic components and could be dual-use. Other types of dual-use output identified include codified knowledge, such as licenses and management principles. In terms of dual-use inputs, these are most likely to represent capital and labour. Capital can be in the form of equipment, machinery, tools, plants and other production facilities. Skills refer to know-how embodied in the technology from researchers, managers and employees.

2.7.4 High Technology

The Oxford English Dictionary defines high technology as advanced technology. High technology is also popularly called the 'Third Wave", 'new industrial' and 'entrepreneurial' initiatives.[129] High tech industry can be defined as:

…. the design, development and introduction of new products and innovative, manufacturing processes, or both, through the systematic application of scientific and technical knowledge. [130]

Malaysia's MITI, for example, defines 'high technology' as companies committed to projects requiring R&D expenditure equalling 1% of sales within 3 years of start-up and having 7% of the workforce comprising employees holding post-secondary certificates or diplomas in technical subjects.[131] MITI's list of specific activities to be promoted under the high technology designation includes computers and computer peripherals, liquid crystal displays (LCDs), medical equipment, biotechnology, automation equipment, advanced materials, opto-electronics, software, alternative energy and aerospace.

The high technology sector has been largely supported by direct state intervention in the creation of new enterprises, products, markets and technologies.[132] Government support is vital to push forward risky but potentially productive projects that would not otherwise materialise. Governments assist in identifying market opportunities, fostering local innovation capacities, and making public investments in new technology and private enterprises. [133] High tech companies offer cutting-edge products, advanced state-of-the-art techniques, they also raise expenditure on research and development and hire a higher percentage of workers from technical and engineering fields.Some analysts argue that high tech development is a path-dependent process that cannot be influenced by public policies.[134]

Observers also argue that location factors, such as labour, the cost of living, low taxes, infrastructure and markets are less relevant for the growth of high technology.[135] However, several other studies support the importance of location in that it facilitates high tech development.[136] Further studies dismiss the location factor and argue that high tech industries may achieve development through building business partnerships and extensive interpersonal networks among distinct firms to exchange technical and market information.[137] The most crucial factor in high technology development is scientific intelligence harnessed to technical problem-solving. A group of analysts argue that the success of high tech industry is not based on location and traditional competitiveness, but rather on factors such as the low cost of labour and low cost of commodities.[138]

Industrial clustering is discussed earlier in this chapter. A prominent feature of high technology industry is the associated *geographical cluster* effect. Industrial clustering has been identified as an effective way of nurturing high technology industries to stay competitive.[139]

2.8 Determinants of Innovation

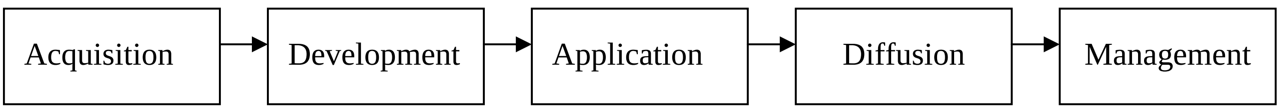
Discussions on the origins of technology mostly revolve around two interpretations- *science push and market pull.* Science-push relates to technology development resulting from the injection of new science and the adding of knowledge or the offering of new methods. On the other hand, market-pull means that the market solution drives technology. In other words, profit and markets determines the direction of technological development. Most literature claims that technologies are stimulated by market need.[140] However, technology development requires science-push and market-pull to work hand-in-hand. It is claimed that although science push is initially important for knowledge accumulation, market-pull will soon take over in the later stages of the technology's life cycle.[141]

2.9 Technology Transfer Process

There are two types of technology transfer: vertical and horizontal transfer.[142] Vertical transfers are the transfers from general to specialised levels and from the scientific level to the final product form. It can also be referred to as a flow of knowledge between pure and applied research and product development. Horizontal technology transfer is the transference from one country to another, or from one application to another. Examples of horizontal technology transfer include licensing, know-how agreements, technical cooperation agreements, training of personnel, conferences, attachments of consultants, and the importation of machinery, equipment and raw materials. Vertical technology transfer is more common in developing countries.

Various literature search on technology transfer process shows that technology transfer involves five main steps as shown in Figure 2.4 below.

Figure 2.4: Technology Transfer Stages



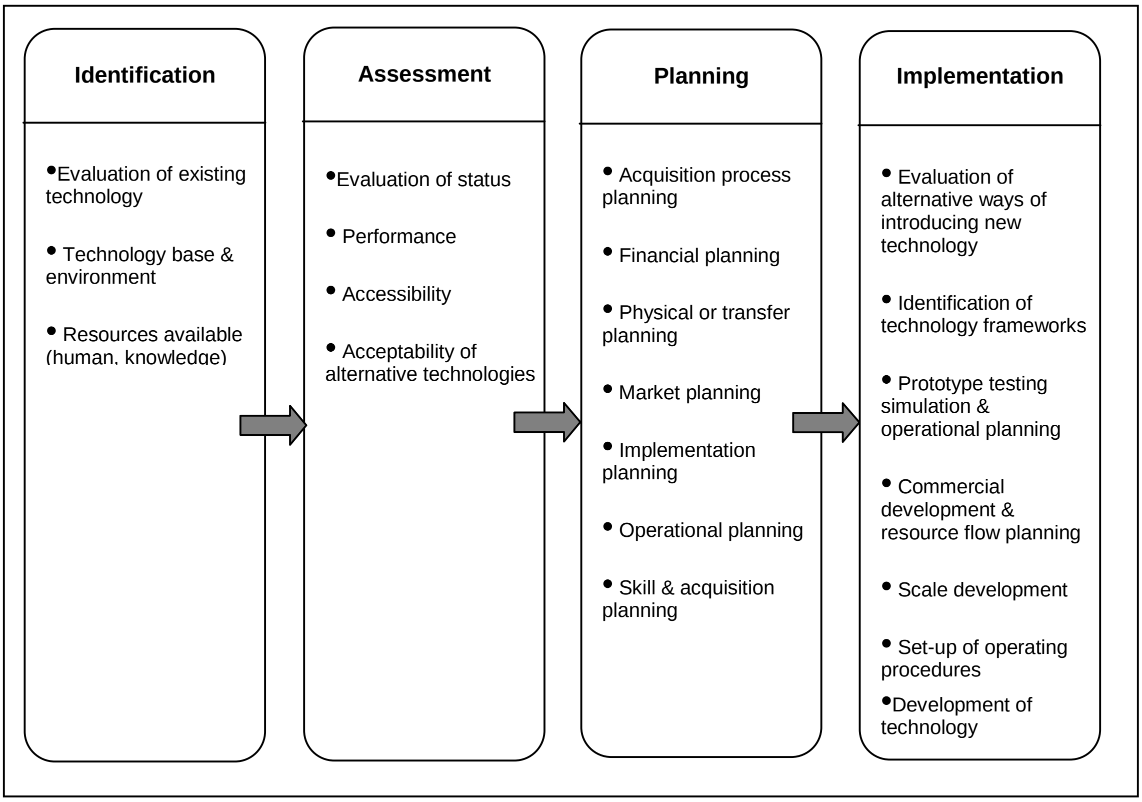
Source: Author

The acquisition stage involves identification, assessment, acquisition and the mastering of new knowledge and technology. At the development stage, further technology transfer contributes to the innovative use of knowledge and skills. At the application stage, technology is used to address the needs of government, industry and the community. Diffusion involves the dissemination of new knowledge and technology through learning and other programmes and the use of technology in solving problems. Finally at the technology management stage, the effectiveness and efficiency of technology usage will be gauged.

Effective technology transfer involves detailed and thorough planning. Prior to the transfer process, critical issues must be addressed, such as the need for the particular technology, technology absorption capacity, resource availability, proper social, economic and technical environment for the technology, and appropriate factor prices for the effective use of technology.

Generally, the process is divided into four main steps: the need for identification; technology assessment; planning; and implementation. Details involved in each step are outlined in Figure 2.5. The technology transfer process into developing countries is often complex, and subject to many problems. These include the lack of an understanding of the extent of technological change, overestimation of absorption capacity, the setting of unrealistic or inapplicable objectives or standards. Further, there is lack of cooperation between donors and recipients, the lack of follow-up and continuity, insufficient resources, excessive delays in the technology transfer process, lack of adequate maintenance, inadequate training, and incompetent management and the inappropriate use of technology.[143]

Figure 2.5: Technology Transfer Process



Source: Ernst G Frankel, *Management of Technological Change*, Kluwer Academic Publisher, Netherlands, 1990, pp.88-89.

2.10 Technology Development Paradigm

There are numerous technology paradigms, namely the western model, soviet model, Far East model and the African model. Their industrial and technology development strategies incorporating considerations, such as government policy, choice of technology, innovativeness and resource allocation are shown in Table 2.6. Based on these paradigms, Malaysia has emulated the East Asian model. It has a very high export-driven industry, but at the same time, government has promoted indigenous high technology manufacturing capabilities through an ISI policy. The Malaysian government practices selective intervention by providing incentives and infrastructure to promote industrialisation. The development of indigenous technological capabilities is at the forefront of attaining competitiveness. However, the country has yet to achieve the desired results due to the lack of highly skilled human resources, government policies to protect Malay-owned industries under the *Bumiputera* special rights, competition from low cost, high productivity neighbours and the lack of research and development budgets for technological development.[144]

Table 2.6: Technology Development Paradigms

MODEL	PARADIGM
Western	• Market driven /limited government role • vertical disintegration • high innovation • huge research and development budget • high competitiveness • capital intensive • high productivity
Soviet	• central planning • labour intensive • low cost production • reverse engineering • minimal innovation • low competitiveness
East Asian	• 'hybrid' model • strong government support • market-driven • export-oriented • reverse engineering leading to innovation • high quality , low cost • from assembly-type manufacturing to high technology and service industry • moving from labour intensive to capital intensive
African	• involutionary • agricultural based • labour-intensive

Source: Author.

2.11 Objectives of Technology Transfer

The objectives of technology transfer have been discussed at length in the literature on technology. Generally, there are two dimensions to analysing the objectives of technology transfer, those of the seller and the buyer. Buyers normally transfer technology for several reasons. First and most importantly, technology is transferred for commercialisation or profit making. The first sale is often seen as an effort towards establishing a good reputation in the local market. This will create a positive feedback which paves the way for future sales. However, the supplier will attempt to retain control over the use of the technology transferred even after the expiration of the contract period. This will form part of the negotiations, as the recipient country will otherwise employ the technology as part of its modernisation strategy.[145] Suppliers are seldom worried about competition on international markets from their developing country customers because in line with the product life cycle theory, most of the technology transferred is obsolete and has been replaced by newer generations of technologies.

Second, technology transfer is a method of cost-sharing as technology production is very expensive. Developed countries have to obtain a sales return on investments in order to venture into newer technologies.[146] Third, technology transfer is also undertaken in certain industries, especially defence, as a means of providing allies with superior technologies. The US, for example, during the Cold War transferred technology to other NATO countries and its developing country allies to defend themselves against the Communist threat. Suppliers also transfer certain technologies, such as those linked to health and education, to enhance the social-economic development of developing countries.

By contrast, buyers require technology transfer to build indigenous technology capability. It is too costly and time consuming for them to develop independently the same technology. Buyer countries therefore, will try and obtain technology which they can use to operate, establish new production units and expand existing ones, develop new techniques, and innovate. However, using new technologies is not an automatic or simple process. New technology can be very complicated, involving complex processes and continuous learning cycles. Therefore developing countries need to invest into technology capacity-building to develop indigenous expertise.

2.12 Theoretical Approaches to Technology Development

2.12.1 Early Theories on Technology Development

Early theories on technology development were mainly focused on the demand side. Most literature in the early 1900s talked about technology usage in the form of a 'blueprint'.[147] A technology blueprint contains complete information relating to the efficient use of technology. This approach presumes that technologies will diffuse from advanced countries to developing countries easily, similar to how technology diffuses in their own country of origin. In this case, developing countries, largely importers of technology, are assumed to have absorbed technology relatively easily, with limited assistance, limited costs and low-risk. This assumption neglects issues such as the availability of skills, capabilities, institutions and infrastructure in developing countries.[148] The dual economy model in the 1950s and 1960s, for example, emphasised structural change and technique choice, but paid very little attention to 'black box' matters.[149] The infant industry argument focuses on the protection of local industries by encouraging trade protection mechanisms to nurture growth and competitiveness of infant industries. However, this theory failed to discuss issues such as additional investments by firms in technology, learning and infrastructural development.

2.12.2 Neo-Classical Growth Theory

The neo-classical growth theory assumes that technology is a public good, available equally to all. Technical knowledge cannot be monopolised. Firms regardless of their nationality should have equal opportunities to exploit the fruits of scientific and technical advance around the world. Thus, when a firm makes an investment decision, the neo-classical growth theory believes that it can incorporate 'state-of-the-art' technology into its new plant and thereby be competitive in world markets.[150]

2.12.3 Technology Gap Theory

By contrast, technology–gap theory emphasises technological backwardness and the need for catching up with technology leaders. The underlying mechanism of knowledge diffusion in this stream of thought is a mastery of a developed country's technology by developing countries. This theory clearly recognised the need for building sufficient domestic capabilities for imitation of technological knowledge but recognised the huge costs involved.[151] Without a sufficient level of domestic capability, requiring massive investment, a country is unlikely to benefit from the technological knowledge of developed countries and thus faces the risk of continuously lagging behind advanced countries.[152]

2.12.4 Macroeconomic Theories of Market 'Imperfections and Informational Economics'

These theories argue that information is always imperfect and markets are always incomplete.[153] There is a question regarding the market mechanism for allocating technology resources. Information asymmetry and missing markets are seen as creating underinvestment in technology development, thus providing the rationale for government intervention to promote technological development. [154]

2.12.5 Evolutionary Theory of Technology and Growth

This theory argues that the origins of technology development occur at the micro level and that 'tacit' knowledge is a crucial element of technology and technology development. Technology cannot be easily transmitted or communicated. Nelson and Winter claim that economic change takes place in an 'evolutionary' fashion, where firms are constantly in competition with each other in an unstable environment. In this instance, firms are behaving like organisms constantly under threat and using the resources available to maintain their existence. The innovational actions of economic agents are seen as being highly dependent on in-house expertise, technical skills, patents, reputation, links to specialist suppliers and the skills necessary to absorb technological knowledge. This also reflects that a given technology will diffuse among potential users in a varied manner, depending on each individual's technological absorptive capacity.[155] Therefore, successful transfer of technology is highly dependent on the capabilities and skills necessary to absorb technological knowledge. In this case, the recipients are seen to act with 'bounded rationality'.[156]

The evolutionary theory group has developed the idea of a 'National Innovation System' (NIS). NIS is defined as a network of public and private sector institutions which act to initiate, modify and diffuse new technologies. The functions of NIS include the creation of new knowledge and guiding the search for existing knowledge and supplying resources such as capital and skills. NIS consists of the government, scientific and research institutions, universities, training centres and private firms.[157]

2.12.6 Endogenous or New Growth Theory

Endogenous growth theory or new growth theory argues that technology is appropriated and monopolised by its innovators. Once technology has been mastered, it is difficult for others to catch-up due to the difficulty of increasing returns to scale of physical and human resources, and geographical localisation of technology.[158] Today, technological leaders attempt to restrict transmission of their most advanced technologies to foreign competitors and protect their intellectual property rights, especially from the encroachment of developing countries. Recipient governments and firms, however, attempt to obtain control of these advanced technologies, as these have become factors in economic growth and international competitiveness. This theory stresses the roles of innovative investments, human capital accumulation and externalities as the dominant factors that determine long-term economic growth. Although the endogenous theory of growth identified knowledge spill-over as potential sources of growth, empirical support for such externalities is not yet conclusive.

2.13 Issues in Technology Development

2.13.1 Technology Learning and Capability Building (TCB)

Technological learning is not straightforward. It is often tacit, complex,[159] costly, time-consuming, involving huge investment, with the results uncertain.[160] In the learning process, most developing countries start with labour intensive technologies where skills are low, learning is short and less risky, and with minimal inter-firm or inter-industry coordination. Once these countries have mastered a technology, there is a process of upgrading and deepening. After this is achieved, developing countries then progress into more advanced technologies and functions to remain competitive.[161] Certain technologies take a longer learning process than others because they are more difficult to master, involve greater effort but have stronger potential for competitiveness.[162] Learning achievements are said to be the underlying features of Asian societies.[163]

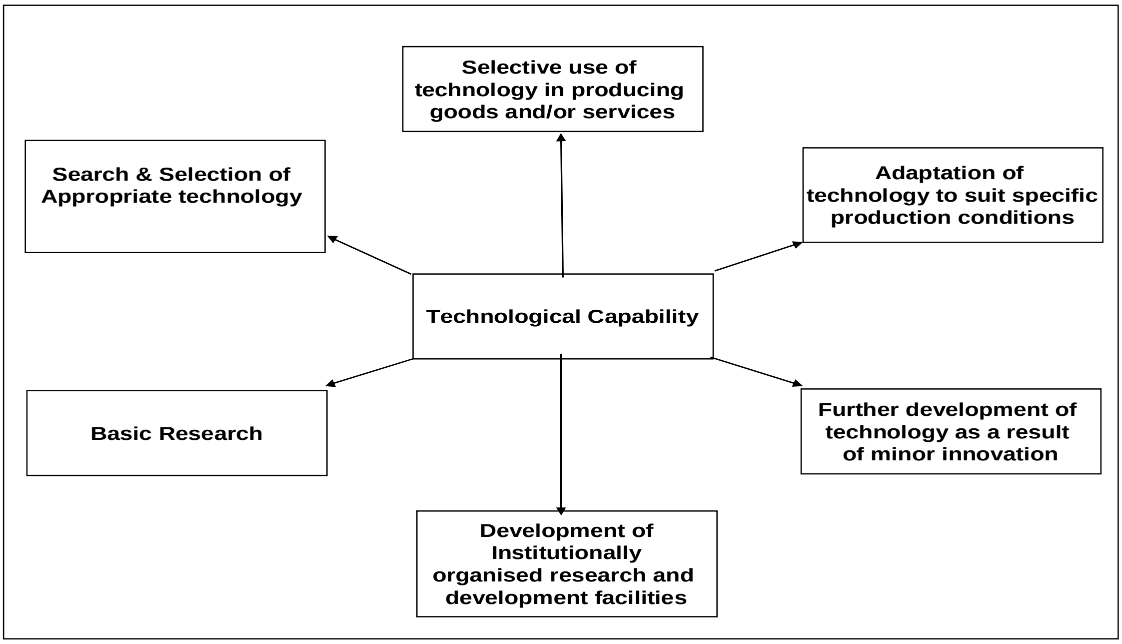
Technology capability building (TCB) involves a comprehensive learning process.[164] However, this cannot occur automatically and requires large resources and commitment from the participating firms.[165] People and skills are very important for TCB to be successful. In countries such as Singapore, Taiwan and South Korea, acquisition of human capital has been included in their education policy objectives.[166] In recent years, much has been written about the importance of TCB in developing countries. TCB involves a mixture of information, skills, interactions and routines that firms need in order to develop technology.[167] Routine capability development involves the capability to use the technology as much as resources to produce goods and services at a given level of efficiency, using a combination of factors such as abilities, equipment, products and production specifications, organisational systems and methods. On the other hand, innovative capabilities include the capability to carry out technological change to encourage the use of distinctive resources to generate and manage technological activities. [168]

TCB can be divided into four levels. At the first level, is the operational function involving basic manufacturing, demanding troubleshooting, quality control, maintenance and procurement skills. The second level involves duplicative skills investment capabilities to expand capacity and purchase and integrate foreign technologies. At the third level are the adaptive skills involving importing technologies, adapting and improving them, and design skills for more complex engineering. Finally, the fourth level involves innovative skills, including R&D to keep pace with moving technological frontiers and to generate new technologies. For most developing countries, TCB is at the first or second level with a few at the third level. The Far East area, and some Latin American countries and South Africa are at the third level, and they are making strong efforts to move into the fourth level. Countries like Malaysia are basically in transition from second to the third level.[169]

Sanjaya Lall identifies six components for developing country technological capability as shown in Figure 2.7. These six components are namely: the search and selection of appropriate technology; basic research; technology adaptation to suit specific production conditions; development of institutionally organised research and development facilities; selective use of technology to produce goods and services; and the further development of technology as a result of minor innovation. [170]

TCB is a contentious topic. For instance, there are arguments that foreign suppliers are not making sufficient efforts to transfer actual knowledge and develop the learning curve.[171] Developing countries are encouraged to break loose from this chain and reduce their total reliance on foreign technology, increasing the flow of technical know-how to individuals and firms within developing countries.

Figure 2.6: Technological Capability Criteria



Source: Sanjaya Lall, Technology Policy and Challenges, *In: 1960 Conference on Globalisation and Development: Lessons for the Malaysian Economy, University of Malaya, Kuala Lumpur, August, 1960*, (Faculty of Economics and Administration, Malaysia, 1960).

Some commentators argue that State intervention has been instrumental in producing successful TCB in developing countries.[172] They claim that TCB cannot be achieved especially in circumstances where developing country market systems are known to be inefficient. [173]Therefore, governments should play an active role through the provision of appropriate policies. Technology policy is crucial to provide the institutional and organisational framework that would allow interested stakeholders in the development process to interact via a supply-demand relationship on a sustainable basis. This has been proven to work not only in East Asia but also in the major industrialised countries during their early days of industrial growth.[174]

However, most progressive developing countries do not follow the TCB path, due to the lack of investment and resources.

2.13.2 The 'Visible Hand' Approach to Technology Development

One group of academics advocate that market forces alone cannot produce the maximum allocation of resources for technological development.[175] Problems which arise from market failures such as the asymmetrical nature of technological knowledge and the under-returns from technology investments require strong government intervention in developing countries.

The East Asian countries (NICs), for example, are known for their policies of departing from *laissez faire* practices. This group of countries focus on selectively intervening by targeting particular activities ('picking winners') as opposed to functional intervention which is aimed at improving markets, without favouring particular activities. However, in some instances, this intervention policy is viewed as a 'hybrid' which lies between 'functional' and 'selective' intervention called 'horizontal' intervention.[176] Horizontal intervention refers to policies that go beyond promoting selected activities across sectors, providing specific economic benefits. Most importantly, horizontal policies address activities for which markets are missing or particularly difficult to create in developing countries such as R&D types of activities.[177] Sanjaya Lall argues that technology development involves a mixture of all three types of intervention-selective, functional and horizontal technology development approaches, the exact mix varying within the country context and capabilities of its policy makers. Government intervention is acknowledged as a key ingredient to guide resource allocation in developing countries.[178]

However, government initiatives to formulate technology policy depend on the technical changes that take place at the industry level. Sanjaya Lall, again, explained the extent of government intervention required within the neoclassical and evolutionary types of technological change. According to him, the neoclassical approach relates to technology development taking place in small, homogenous firms operating in a perfectly competitive market, where technology options are known, and choices are made costlessly to optimise allocation on the basis of capital and labour costs; the technology being absorbed and used without further effort or cost.[179] In such instances, where firms need not learn to use the existing technology, and operate in isolation without interlinkages and spill-over, government intervention is limited. On the other hand, the evolutionary theory of technology change (propagated by Nelson and Winter), argues that firms do not work with full information of technical alternatives.[180] They operate in imperfection, with asymmetrical knowledge of the technology they are using. The companies need time and effort to learn the technology efficiently and to conduct technological effort.[181] In this case, government intervention through the formulation of science and technology policies is vital for promoting and extending technology learning.

A science and technology policy is viewed as an important strategy for developing countries to develop technology.[182] Formulation of a sound and comprehensive technology policy with components such as a technologies wish-list, technology directions, technology development strategies and technology operational issues are vital for assisting structured and systematic technological development. The absence of such a policy could result in the acquisition of expensive and unsuitable data. In many countries, a sound science and technology policy has helped governments save cost and time looking for the right technology.[183]

The Washington Consensus (WC), however, took a neo-liberal approach where well-functioning markets can achieve efficient and optimal resource allocation in all sectors. The WC paid less emphasis on government intervention and called for developing countries to create a correct set of incentives, 'getting the prices' right. It was argued that industrial policy reform should focus on removing 'policy induced' distortions arising from State interventions, privatisations and restrictions on private enterprise. In contrast to the WC approach, the post-consensus group argue for a greater government role for technology development in developing countries; this is to be done through: i) selective intervention through industrial policy, ii) strategic intervention in trade policy, and iii) the creation of a national innovation system.[184]

2.13.3 Costs of Technology

Technology does not come free. Technology owners, mainly from the developed countries, who have invested large amounts of money into developing new technologies, will only agree to transfer the required technology for a fee to developing countries. Such direct costs are normally spelled out in written agreements between the sellers and the buyers. The costs are for the granting of licenses, transferring know-how, training courses and technical assistance. Nevertheless, in developing countries buyers have to take into consideration indirect costs, including the cost of choosing an inappropriate technology or supplier, selecting an obsolete technology or a technology that is in competition with many other emerging technologies, or the inability to fully utilise the technology due to the lack of information, knowledge, infrastructure or skilled labour.[185] In some instances, the supplier will impose a higher cost on a technology that is being transferred to recipient country if it is aware that the particular technology has less potential to be commercialised.

2.13.4 Competitiveness and Technology Development

Sustaining a competitive industry seems to be the biggest challenge facing developing countries in the 21st century.[186] Scholarly work highlights the challenges faced by developing countries to industrialise.[187] The reasons include the existence of competition from industrialised countries with a wider market share, the changing structure of world trade and finance and the availability of more advanced technology to developed countries. Further, in many of the developing countries, the global value chains and integrated production systems are unlikely to be spread evenly due to inherent technological developmental problems.[188] These countries realise that maintaining competitiveness is vital to attaining sustainable industrial development[189].

Competitiveness means different things to different segments of society. Firms say that competitiveness is the ability to compete in world markets with a global strategy. For government, competitiveness means a positive balance of trade. Economists argue that competitiveness is all about achieving low-unit costs of labour adjusted for exchange rates. Measurements of competitiveness include sponsorship of R&D, profit levels, management practices, labour unions, balance of trade, labour productivity rates and export market penetration.[190] Drivers for competitiveness include foreign direct investment, skills, domestic R&D, licensing, economic strength, government, exchange rates, finance, infrastructure and management. [191]

Competitiveness can be viewed from both the macro and micro levels. The macro level of competitiveness is focused on macroeconomic issues such as monetary and fiscal policies, a trusted and efficient legal system, a stable set of democratic institutions and progress in social conditions. Micro level competitiveness, on the other hand, depends on the sophistication with which foreign sub-operators or domestic companies in the local country operate, and the quality of the microeconomic business environment in which firms operate. [192]

Nevertheless, in an era of globalisation, technology has been identified as a *sine-qua-non* for maintaining national competitiveness.[193] Technology is seen as the key factor for competitiveness. Technological progress is crucial for the growth process and fundamental for achieving rising per capita income as it determines the rate at which natural resources can be exploited and capital stock be expanded to enhance productivity and maximise output and income.[194] It is for this reason that economically developed countries tend to be those that are also industrially and technologically advanced.

Porter's[195] famous national competitive advantage model is an important framework for evaluating industrial competitiveness.[196] His theory begins with individual industries and competitors and builds up to the economy as a whole. Nations should decide the success factors to achieve competitiveness and the ability to sustain it. Porter's diamond model illustrates the key issues for achieving competitive advantage of nations and is shown in Figure 2.8: demand conditions; factor conditions; related and supporting industries; and firm strategy, structure and rivalry. Porter lists 'government' and 'chance' as additional factors.

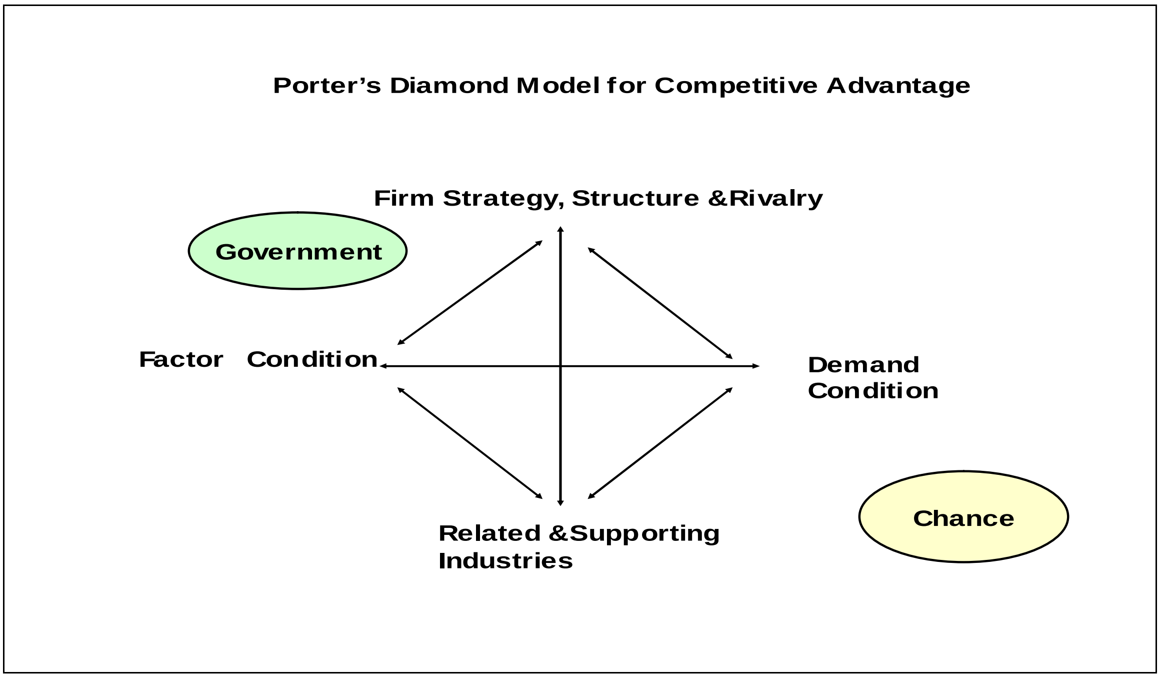
Porter's model influences the role of technology in achieving competitive and sustainable industrialisation. Factors of production such as a strong technological base, indigenous capability and knowledgeable human resources are required to attain competitiveness. Sophisticated and demanding customers will create the challenges to improve product quality. Reliable and strong supplier bases will also help to reduce costs, create clusters, innovative inputs and good inter-and intra-industrial linkages.

Finally, a firm's strategy in terms of investment in research and development, science and technology policy and human resource development will be fundamental to maintaining industrial competitiveness. While chance can never be controlled, the impact of government policies can be instrumental in increasing industry performance. Smart partnerships between the government and industry have been identified as the way forward for achieving sustainable industrial development. Governments have developed strategies, identified skills, market requirements, 'strategic' industries and critical technologies to achieve competitiveness. Many of the countries in the developing world adopt a selective interventionist role to prop up infant industry and at the same time prepare them to face a more challenging international environment.

Jin Zhouying argues that competitiveness derives from innovation that is transformed into industrial technologies (or military applications) through commercialisation.[197] Jin explains that market application of hard technology occurs by means of soft technology and therefore soft technology is the key to technology and economic competitiveness.

Jin further explains that the economic success of contemporary developed countries can be attributed to factors relating to the emergence of new business technologies, venture capital and the development of financial instruments like derivatives. Developing countries on the other hand, are characterised by the absence of soft technology and limited abilities to make effective and efficient use of the technology they obtain through a variety of transfer mechanisms to innovate and compete in the global market.

Figure 2.7: Porter's Diamond Model



Source: Michael Porter, *Competitive Advantage of Nations*, Simon &Schuster Inc, New York, 1990.

Developing countries, according to Jin, rarely benefit from technology transfer because of the low efficiency they exhibit in absorbing the technology acquired. The problem of low efficiency in technology absorption results mainly from the incompleteness of the soft technology environment. Jin argues that soft technology is often neglected in developing countries.[198] Jin highlights the macro environment consisting of hard environment issues such as such as infrastructure, the industrial base, economic strength and the capacity to provide capital investment. He also emphasises the soft environment issues, such as policies, laws, rules and regulations, the international environment and market conditions as being crucial for increasing and sustaining development.[199]

In recent years, a new phenomenon in the form of globalisation has had a profound impact on industrialisation and technological competitiveness in the developing world. Despite the huge benefits accrued, globalisation is claimed to have produced uneven progress between the developing countries in industrialisation and technological development.[200] Sanjaya Lall, in his contribution to the *Industrial Development Report* (2002/2003) for the United Nations Industrial Development Organisation (UNIDO), outlined several issues that that have shaped developing country technological and industrial competitiveness, due to the effects of globalisation.[201]

These include:

i. Economic distance being shortened due to the rapid growth of technical efficiency in areas such as information processing, transport, clearly reducing natural protection enjoyed by countries. Subsequently, this event has increased international competition far more quickly and intensely.
ii. Adoption of new technologies, covering not just products and processes but also new methods of organising firms, managing international relations and supply chains, linked to innovation.
iii. Constant technological effort whereby developing countries have to invest in absorbing and adapting technology, most importantly allowing these countries to specialise in particular processes and functions within the global production chain.
iv. The gain for high technology sectors due to enormous structural changes with innovation-based manufacturing activities.
v. Changed patterns of competitive advantage as exports grow in response to innovation and relocation.
vi. More coordinated industrial value chains within firms and externally where functions and processes are subdivided and located across the globe to take advantage of fine differences in costs, logistics, markets and innovations. Countries that have been able to penetrate and become part of the dynamic value chain have seen significant increases in employment.

Sanjaya Lall, however, highlighted the fact that developing countries are constantly increasing their overall competitiveness and moving into dynamic technology-based exports, concentrated both by region and by country. He claimed that the local depth and 'rooting' of high technology may vary greatly among successful exporters, and those with shallow roots may find it more difficult to sustain their recent growth of competitive production.

Based on the above assessment, technology will continue to feature as the cornerstone of industrial competitiveness despite the challenges. Most importantly, firms must process both hard and soft technologies in the form of equipment, patents, designs and know-how. Firm competitiveness will be obtained through 'learning by doing' where firms will be exposed to a multifaceted technological learning curve, including problem-solving, managing technology processes, inter-and intra-firm interaction and the ability to market and export their products. Continuing access to new technologies including new products, new processes, management techniques, forms of linkages between buyers and suppliers and tighter relations between technology and science, are essential for sustaining competitiveness.[202] Such access could be obtained through various agents such as MNCs, consultants, research institutions, international organisations and governments. These agents use various modes of transfer, namely, foreign direct investment, joint ventures, turnkey projects, licensing, technical arrangements, subcontracting and offsets, to transfer technology.

2.14 Technology Acquisition Modes

There are various types of technology acquisition modes, such as off-the-shelf purchase, sub-contracting, joint-ventures, licensing, co-production, collaboration and research development. This section discusses the various modes of technology transfer; the advantages as well as the disadvantages of utilising each method to acquire technology.

2.14.1 Off-the-Shelf Purchase

Off-the-shelf purchase is the straightforward purchase of technology. Here, the transferor takes full responsibility to design, supply, install and operate the product or system. The buyer will only select the consultative direction and assume responsibility for the supply and installation of machines, equipments and systems. Normally, the seller will provide consultation facilities for a period of time. There is often a complete lack of local consultancy advice to follow up or support the equipment or system after the warranty period. This attitude forces the buyer to be continuously dependent on the seller for through-life support of the equipment or system purchased. Off-the-shelf purchase makes very minimal technology transfer contributions.

2.14.2 Foreign Direct Investment (FDI)

FDI is claimed by some authors to be the most successful mode of technology transfer into developing countries.[203] FDI is a medium for acquiring skills, technology, organisational and managerial practices and access to markets. It has also been used to insert countries into global value chains and to build competitiveness in the changing new economic order. Multinationals (MNC)[204] bring in investment, new technology, new varieties of products and new organisational forms into host countries.[205] A greater MNC presence tends to lead to a more rapid ‘catching up’ by the host country with respect to the advanced countries.[206] FDI in developing countries is increasing rapidly, from an average $29 billion in 1986-1991 to $ 208 billion in 1999.[207] FDI dependent countries are reported to be climbing the technological ladder**.** [208]

Why do MNCs transfer technology? Vernon argues that MNCs transfer technology by reference to the international product life cycle theory.[209] Vernon, employing the example of US manufacturing industry, mentions that at the early stages of the product life cycle, US controlled enterprises generate new product and processes in response to the high per-capita incomes and relative availability of productive factors in the US.[210] At an early stage, there is massive R&D leading to innovation and development. The industry is dependent on know-how and provides specialised services. There is an element of monopolistic pricing and large profits.[211] At stage two, being the growth stage, there is a gradual introduction of mass-production methods and variations in production techniques. At this stage, there is an entry of many aggressive investors attracted by large profits. There is also a natural tendency towards price elasticity leading to intra-industry competition and subsequently price reductions.[212] Finally, Vernon mentions that in stage three, the product becomes fully *mature*, and production technology is fully understood and standardised. Possibilities for further innovation are rare, monopolies are eroded, output falls off and price falls to a minimum 'competitive' level. At this stage, the underdeveloped countries have a comparative advantage in production since unskilled labour has become the major inputs, and these are, of course, cheaper in developing countries.

Nevertheless, Vernon's model has been heavily criticised by academicians and practitioners**.**[213] To start with, the international product life cycle theory itself is condemned as it has set the destiny of developing countries to be forever technological 'followers', constantly picking up the scraps of technology, which have become obsolete in the rich countries.[214] The extent of the linkages developed through FDI is also highly questionable. Linkages with local companies are rare as a MNC produces and imports the required inputs, rather than obtaining them from domestic suppliers. Linkages normally depend upon the stage of development of indigenous industry, the availability of local skills and technology, institutions and government policies, changes in demand and technology in world markets and their political attractiveness to MNCs.[215] It is argued, however that, FDI has not been successful in developing such strategies.[216]

MNCs are criticised for transferring intermediate products (knowledge) across international boundaries while still retaining control of them**.**[217] This is to maintain a specific advantage and to retain their monopolistic status to overcome fear or lack of knowledge of foreign markets. These *specific advantages* rely on entry barriers for protection and sustenance. Market imperfections enable MNCs to utilise their oligopolistic power, including the specific advantage of close market proximity and superior rents on activities.[218] By possessing advantages such as scale economies, knowledge advantage, distribution networks, product diversification, and credit advantages to enhance asset power, the MNCs dominate markets.

FDI is also criticised by development economists because of its negative impact via pricing,[219] minimal value-added activities and arguably inappropriate capital intensive investments in labour abundant economies.[220] MNCs exploit their monopoly positions in domestic economies, creating beneficial competition, efficiency and jobs; but tending also to be highly exploitative.[221] MNCs are also accused of being ‘footloose’, thus relocating to wherever they have a production advantage.[222] Home and host country policies usually influence FDI movements. However, unstable political and economic conditions in host countries may reduce the attractiveness of FDI.

FDI has become increasingly popular especially in EOI countries. It is claimed that FDI increases foreign currency earnings, human resources, employment and linkages into the economy, such as the development of local suppliers and sales to intermediate goods industries.[223] FDI has been important in manufacturing sectors, such as the electronics industry in Taiwan, Malaysia and Thailand. Countries, such as Singapore, have been more prudent in ensuring that FDI is channelled into high-tech industries to maximise technology competitiveness. By contrast, other countries, such as Malaysia, Thailand, Philippines and Mexico have ended up with assembly line production industries, lower skills and technological capability. FDI can promote indigenisation and local technological capability building, but has proved otherwise for some countries. They now seek more genuine modes of technology transfer to develop inhouse technology capabilities.

2.14.3 Turnkey Operations

Turnkey projects are also called BOT (build, operate and transfer). They involve the total construction of a project: product- and project-design, plant-engineering, procurement and manufacture of equipment, construction management, commissioning and training and trouble-shooting. At some future time, the project is handed over to the customer. The prime contractor will normally take responsibility in setting up a complete industrial plant. The project is packaged with the provision of various skills, services and finance to provide a functioning plant to the client. Demand for turnkey projects among developing countries is on the rise. However, there is a question regarding the viability of setting up a complete plant in smaller developing countries, consisting of a smaller domestic-goods manufacturing base.

2.14.4 Licensing

Licensing is defined as the transfer of patents, brand names (including technical assistance), sales of know-how and assembly under contract. Most of the time, licensing takes place across national boundaries rather than between firms in the same country. Licensing of technology involves explicit outlays of proprietary information freely purchased by firms owned by nationals of one country from firms in another, as well as payments made by subsidiaries of the MNC for the use of parent company knowledge. Costs, besides royalty payments, include the loss of profits from restrictions on exports to third countries and inputs that must be purchased from the purveyor of the technology. Knowledge that is purchased falls into several categories, including pre-investment feasibility studies, detailed studies, basic engineering, detailed engineering, procurement, training, construction and assembly, startup or commissioning, technical assistance agreements, trademarks, copyright licenses and troubleshooting. A licensing agreement typically has patents, technical know-how, trademarks, marketing know-how, managerial know-how and design incorporated into the agreement.[224]

Licensing is preferred in technologies that are not complex, with strong, well-enforced and relatively mature patent, not relying on ‘user-active’ innovation requiring strong links between marketing and product development. Licensing has been an important alternative form of technology access in sectors such as pharmaceuticals. Licensing and collaboration often complement one another in the microelectronics, robotics and biotechnology industries.

Licensing imposes various challenges to licensor and licensees. Licensors are normally worried about losing their technological niche if licensees do not honour the agreements. In countries such as China and Taiwan, licensees have failed to adhere to licensing contracts thus creating duplication of products available at cheaper prices. The absence of copyright and patent enforcements has made developed country contractors lose their cutting edge technology. These and other issues have caused licensors to impose various restrictions on the usage of technology, including where the output should be marketed and what type of purchases must be made from the licensor to make the transfer technically effective. This is to assure that the licensors enjoy an advantageous position in the licensing agreement. Licensors will jealously guard their technology, as any duplication of competition will drive returns down. Companies will normally license peripheral rather than core technologies to maintain their competitive advantage.

On the other hand, licensees perceive foreign technology licensing payments to be unreasonably expensive. The licensee should be cautious in acquiring licenses so as not to indulge in costly and unfamiliar activities.[225] However there is an alternative view that developing countries pay only a fraction of the initial R&D cost, with the developed countries having to bear the cost of larger research facilities and skilled researchers.[226] Royalty payments through licensing are justified as an attempt to obtain some contribution towards development costs as well as compensation for exports income forgone. Further, in many licensing deals, there is an absence of well-educated individuals with adequate technical backgrounds to scrutinise the technology cost. Licensing agreements can also either be obsolete or too advanced.[227] Despite the problems, licensing has been widely used by developing countries as a mode of inward technology transfer. Licensing will be successful if there is a commitment from the licensor to transfer genuine technology to the licensee and for the licensee to honour the contract by protecting the transferred technology.

2.14.5 Sub-Contracting

Subcontracting involves a contract with one or a number of firms to assemble or manufacture parts. It is defined as an interrelationship between enterprises to provide not only an outlet for production by suppliers, but also the establishment of a relationship between linked enterprises whereby long-term contracts are entered into, product information exchanged, prices negotiated, technology shared and other forms of assistance made possible.[228]

Sub-contracting involves linkages to the established local suppliers to obtain intermediary inputs. In some countries, foreign companies are required to sub-contract their activities to local firms as a means of protecting small and medium size industries. The more important backward linkages can be categorised into three types of decision making; namely, the decision as to whether: [229]

i. To make or buy.
ii. Procure locally, giving rise to the possibility of local linkages or through imports, the creation of national or international linkages.
iii. Linkages can be technical, financial, procurement, locational, managerial, and pricing.

Supply chain networks have become a prominent component of subcontracting activity. In the East Asian economies, sub-contracting processes have created global supply chains. There are many definitions of a supply chain. One used by the Cranfield University is:

The network of organisations involved, through upstream and downstream linkages in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer[230]

This international complex system of networks includes a variety of ties with sales, manufacturing and engineering support affiliates of foreign firms; they also include different forms and trajectories of integration into global production networks of MNC firms. Taiwanese firms typically have relied on concurrent knowledge outsourcing; they have pursued different applications in parallel, rather than concentrate exclusively on one particular linkage.[231] Supply chains act as cost-reducing, value-adding mechanisms towards supporting a long-term commercial competitive advantage, besides linking industries and economies.

In both developed and developing countries, sub-contracting is viewed both as a vital mode of technology transfer and as an enhancement of linkages.

2.14.6 Joint Ventures (JV)

JVs have become a popular medium of technology transfer, as they offer greater opportunities for the effective transfer of technology.[232] JVs are a business association between foreign investors and local enterprises. JVs are categorised into three main types: dominant parent ventures; shared management; and independent ventures. Dominant parent ventures are managed by a dominant parent, as if they were wholly-owned subsidiaries. Shared management is where both parents play a meaningful management role, with functional managers drawn from both parents. Independent ventures are where both firms in the joint ventures operate their own strategies.[233]

Companies have opted for JVs for various reasons. Overseas companies normally view JVs as a platform for new markets and an access to raw materials. Local companies engage in JVs due to governmental obligations, and when certain projects are too costly, involving huge investments, which the local firm is not able to solely undertake. At times, JVs are required because the host industry does not have the skills, technical expertise and ability to capture the local product market.

The major difference between licensing and JVs is that in licensing there is no sharing of equity between the firms involved. The licensee makes all the capital investment and the licensor simply agrees to provide the technology or a fee as a percentage of the sales. Current technology agreements gives the licensee access to the technology at the time the license agreement is signed, and current and future technology agreements specify the new development work as well as work done by the licensor on a specified product during the agreement.

There have been cases of troubled JVs due to the lack of understanding between the overseas and local partners, unequal sharing of responsibilities, monopoly by one dominant party and government policy restrictions on, for instance, equity holdings. At times, overseas companies refuse to share niche technology, worried that the technology might fall into a competitor's hands. Trust and equal sharing of responsibilities are crucial in determining the success of JVs.

2.14.7 Collaborative Technology Programmes

Technological collaboration has become another important source of technology transfer. It is defined as any activity where two or more partners contribute differential resources and technological know-how to achieve agreed complementary aims.[234] This mode of transfer includes collaboration in product development, manufacture and marketing that spans across national boundaries, is not based on arms-length transactions and includes substantial and continual contributions of capital, technology, and other assets.

There are four types of technology-focused collaborative ventures:

i. Research collaboration amongst firms.
ii. Exchange of proven technologies within a single product line or across multiple products, such as microelectronics and robotics.
iii. Joint development of one or more products, these ventures typifying international collaboration in commercial aircraft, engines and segments of telecommunications equipment, microelectronics and biotechnology industries.
iv. Collaboration across different functions, with one firm providing a new product or process for marketing, manufacture or application in a foreign market.

In contrast to early Japanese development, US and EC collaborations focused on activities further upstream**,** with recent international technology collaboration centered on product development, manufacture and marketing.[235]

Technological collaboration has become more popular than other modes of technology transfer due to its emphasis on long-term partnerships as well as the sharing of management responsibilities amongst partners. It is both broader and more in-depth than joint ventures, requiring strategic alliances and cooperation from every angle, including sometimes the involvement of governments of both transferor and transferee countrys. Such relationships may vary in terms of the legal contracting and equity funding provided by the partners. Most importantly, there must be commitment and trust of the two or more companies to cooperatively develop technology, helping them to keep pace with technological advancements in the marketplace.[236] Many developing countries view collaboration as a transparent and promising way to obtain technology. Nevertheless, the absence of a legally binding agreement sometimes creates problems of enforcement in the event that collaboration fails.

2.15 Research and Development

The technology management literature highlights the importance of R&D as a crucial factor in developing technologies that can eventually be commercialised. R&D enables firms to create new technologies and build on existing technologies obtained through technology transfer. In most cases, the creation of core or strategic technologies calls for the provision of human and financial capital. Countries without a strong industrial base cannot afford the R&D for the development of strategic industries. An excellent science and technology base for economic development has to be supported by high quality human resources and environment and culture that are capable of facilitating innovation. Developing countries have invested in R&D centres and promoted collaboration between universities and industries.[237] However, there is often a lack of proper mechanisms for linking the research institutes, universities and industry. Further, there is also often a lack of trust and *esprit de' corp* between the different players in the fields of research, technology and industry. In many instances, the universities and industry are working in isolation. Universities do not understand the needs of industry and thus rarely satisfy industry requirements. Equally, industries are often not willing to invest in R&D activities, being more focused on short tem profits.

2.16 Offsets as a Tool for Technology Transfer

A detailed definition of offsets was provided in Chapter 1(see p.22). Although offsets became popular in developed countries in the 1940s and 50s, and spread into Eastern Europe in the 1960s, they gained footage in developing countries only in the 1980s. Offsets have gained increased prominence over recent years, now being widely used in defence markets.

There is a substantial literature on why developing countries pursue technology transfer through offsets.[238] For sellers, offsets are viewed as a marketing tool. Many international OEMs claim not be able to compete in the defence market without packaging offsets as part of their defence sales.[239] Offsets do escalate price, as there are transaction costs involved, but offsets help companies to stay competitive in a tight international defence market. Indeed, offsets have become a key factor in defence procurement decision-making in numerous countries.[240]

For buyers, offsets have become a politico–economic tool. In the political sense, offsets are seen as a means of building a self-reliant defence industry. Self-sufficiency in arms procurement is a crucial strategic goal. Past experiences of embargoes, sanctions and other potential threats, have reinforced the need to establish an indigenous defence industry in many developing countries. A further reason has regard to a country's political aspiration to become a regional power through technological prowess.

In an economic sense, offsets have become an important aspect of development strategy. Offsets are seen as an effective delivery mechanism within the defence procurement process to achieve industry development objectives.[241] Since offsets are tied to defence purchases, governments acquire leverage to secure new technologies and capabilities. Offsets also create spin-offs into civil sectors and dual-use application, paving the way for strong backward and forward linkages into other industrial sectors such as steel, machine tools, aerospace and shipbuilding. Offsets are also used to build-up know-how and skills, gaining access to new markets, generating export earnings, creating value-added employment as well as establishing strategic partnerships with international companies.[242]

Papers have been written analysing whether offsets have contributed towards industrialisation and technology development. Stefan Markowski and Peter Hall have looked at the effectiveness of offsets within the Industry Involvement Programme in Australia and New Zealand.[243] They have concluded that offsets have not produced the intended outcomes in these countries. Wally Struys discussed how Belgium used offsets to maintain its defence industrial base, arguing that offsets need to integrate into industrial development policy and focus on sustainable long-term goals rather than immediate short term objectives if they are to be successful.[244] Other writers, such as Stephen Martin and Keith Hartley, question the cost effectiveness of offsets as a means towards promoting defence industrialisation.[245] Michael Chinworth has further argued that although Korea and Taiwan have received advanced assistance through offsets deals, these countries still remain dependent on foreign technology inputs in their respective defence industries.[246] In other parts of the world, such as South Africa and Brazil, empirical evidence has shown that offsets have had a smaller impact than expected. [247]

Other observers argue that developing nations do not possess the requisite capital, neither to engage in arms production nor arms co-production.[248] These capabilities apparently cannot be imported; they need to be grown indigenously. There are claims that developing countries do not have the capacity to produce sophisticated weapons systems due to the lack of scientists, engineers and craftsmen.[249] Countries may lack the absorptive capacity, which cannot be acquired immediately but takes time and resources to develop.[250] Technology advances so quickly that the recipient country will always confront a technology-lag and therefore remain uncompetitive with developed country producers actively involved in technological development.[251]

On the positive side, offsets are claimed to have promoted local subcontracting activity.[252] Sub-contracting via offsets includes maintenance, production of parts and components and local assembly. For example, Australia has benefited from the F/A 18 project.[253] Other countries benefiting from offsets in this regard include Belgium, Spain, Greece and Turkey.[254] South Korea and Taiwan have embarked on offsets to cover part of the cost of defence equipment purchases and increase the levels of industrial sophistication through technology transfer.[255] South Korea managed to leverage a 30% license agreement for in-country production of components and sub-assemblies to compensate for the purchase of 120 F-16 fighters from the US.[256] In South Africa, nearly 132,000 workers are employed in the manufacturing sector due to offsets.[257] The US Presidential Commission on Offsets in International Trade found that the US loses $2.3 billion of work, or 25,300 work-years or the equivalent of 4,200 full time jobs per year due to offsets obligations by its defence contractors.[258] It is also claimed that much defence related subcontracting work goes into developed countries via offsets.[259]

In Malaysia, subcontracting work was provided by BAE Systems in 1992 to SME Aerospace related to the sale of Hawk aircraft. This was followed by further subcontracting work through the purchases of other defence equipment due to the government's local content policy. However, the number of jobs offsets have generated is negligible, and no follow-up has been done to evaluate whether sufficient amounts of quality work have been brought in, or whether the OEMs have been able to create forward and backward linkages through offsets in Malaysia.

Developing countries, with a desire to pursue industrial policies, often find military spending on dual use technology attractive. Indeed, some countries have used offsets arrangements to enhance the capability of their non-defence sectors.[260] Dual use strategy can either be spin-off, from defence to civil, or spin-on, from civil to defence**.** The basic idea behind the spin–off concept refers to the transfer of specific technical innovations from the military to civilian sphere, which are subsequently exploited by the commercial market.[261] South Korea, for instance, uses military spending to obtain defence technology which is later utilised by its civil industries.[262] By contrast, spin-on emphasises the movement of civilian technology into the defence sector. Academic and policy discussion also focuses on the negative aspects of spin-offs. Military R&D is said to crowd-out civilian technological innovation and investment,[263] and arguably military technology is too complex and performance too high for civilian applications.[264] Military technology may not be compatible with the economic and technological environment of the weapons purchasing country, particularly if it is a developing country. It is claimed to be more cost effective to move from civil to military technology.[265]

Employment generation has also been highlighted as one of the benefits of offsets. Developing countries view offsets as an avenue for employment creation. However, the figures substantiating employment creation have been more convincing in the West such as in Spain, Belgium and Britain than in poorer regions.[266] Britain's Westland Company, for example, claims that the Apache programme has created 3,000 British jobs.[267] Spain‘s 1980 licensed production of the US F /A 18 aircraft was claimed to have generated employment in the defence sector from an offset worth $1540 million.[268] However, figures for developing countries are not available.

Data on skills transfer through offsets are also minimal. Questions have been raised as to the extent that skills acquired through military production are applicable to civil industries.[269] Military technologies are complex; they need reshaping and modification before transfer to other sectors is possible. However, do developing countries possess the financial and human resources to carry out technology conversion? No research has been done to indicate whether skill-development encompasses new target groups or the retraining of workers from existing defence industries.

Countries have pursued different offsets strategies to maximise benefits. Ron Matthews[270] has explained the different strategies using a four quadrant model. He identified four types of strategies, namely, defence-defence, defence-civil, civil-defence and civil-civil. For instance, Korea, India, Russia, the UK and the US fall into quadrant one, which is the traditional model of defence-defence strategy, whereby these countries have mainly utilised defence offsets to prop up their defence industries.

Others, such as Saudi Arabia, Oman, Kuwait and Malaysia fall under quadrant two, defence-civil, whereby offsets are used for civil projects. These countries realise that defence industrialisation involves high R&D costs, local economies of scale and a highly skilled workforce. The fact that the Saudi *Al Yamamah* offsets arrangement was instrumental in the establishment of the Tate and Lyle sugar processing complex, the Glaxo pharmaceutical plant and computer training facilities is proof of such efforts. Oman and Kuwait have used their offsets credits for networks of small businesses. In Malaysia, defence offsets have been utilised to leverage technology collaboration with local universities and through the setting up of a ‘smart’ school.[271]

Quadrant three involves civil-civil strategy. This involves commercial contracts, involving aerospace, transport, telecommunications and energy. The fourth quadrant, involves civil-defence offsets. Japan, for example, through dual use industrialisation has been successful in transferring technology and skills obtained from civil projects into the defence sector, thus enhancing defence industrial capability through successful utilisation of civil offsets for defence activities. The question, though, is whether these strategies are static or changeable according to the industrial and technological development of each nation. For example, in recent years, more and more developing countries have been directing offsets credits towards the defence sector with the hope of enhancing and developing a self-reliant and capable defence industry. Malaysia has used much of its offsets credits to enhance defence capability in recent years. The challenge remains of determining the optimal strategy for a country's economic development.

Due to a lack of information, a knowledge gap exists pertaining to issues related to offsets. It is therefore crucial to undertake empirical research into this area. This thesis will attempt to do so by using the example of a developing country, Malaysia.

Malaysia has slowly evolved from being a traditional agricultural economy, pre-Independence 1957. The country progressed into pre take-off in the 1950s and 1960s mainly through import substitution activities in primary manufacturing. Malaysia then embarked on export-oriented manufacturing in the 1970s and 1980s. It entered into the take-off stage during the late 1980s, venturing into high technology sectors such as defence and aerospace in its approach towards technological and industrial development.

This process has been expedited by the dynamic global changes in technology development through globalisation and liberalisation. However, such changes are supported by government intervention to put in place policies focused on infrastructure and the training of workers to ensure that industries are able to take-off into the high technology sectors, being able absorb and apply their capabilities efficiently across a wide range of sectors. Pursuit of indigenisation is in line with a nation's aspiration to attain self-reliance in technological and industrial development. In this context, and in accordance with the endogenous or new growth theory, Malaysia has tried to leverage through defence offsets, high technology, skilled manpower, innovative investments and enhanced research and development activities. However, the government sees the need to protect its strategic industries, including defence industry. This is based on the need to extend assistance to indigenous industries, based on security rather than economic reasons.

2.17 Summary

This chapter has attempted to put forward various perspectives on issues relating to industrialisation and technological development, seeking to establish that technology is the 'answer' to achieving the economic development of underdeveloped countries. Initially, technology was acquired by these countries to achieve self-reliance and technological independence from the advanced Western countries. Today, the debate centres on how economic take-off can be achieved and competitive edge be sustained.

Developing countries have employed various industrial strategies, such as ISI and EOI, to build technological capability. The role of government has been significant in enhancing industrialisation and technological development in these countries. In the more successful developing countries, government have taken an active role in promoting indigenous technological innovation. Government has selectively intervened by providing a suitable political and economic environment for foreign investment, fostering the process of structural development, such as tax-free incentives to foreign investors, and the promotion of infrastructure and transportation structures.

This chapter also highlights the broader definitions of technology, to include hard and soft technology. Science-push and market-pull contributes to technology development. Evaluation of the literature in this chapter also highlights the fact that a well planned technology transfer process is important to ensure smooth and effective technology development. Several technology development paradigms have been put forward, namely the Western, Socialist, Late-Industrialising and African models to indicate the different policies, strategies and mechanisms involved. The chapter looks at the objectives of technology transfer from two perspectives, the seller and the buyer, arguing that both objectives must be met in order to obtain a successful transfer of technology. The various modes of technology transfer, namely, off-the-shelf-purchase, FDI, licensing, sub-contracting, joint venture, collaboration and offsets have been discussed. Issues such as definitions, mechanisms, benefits and disadvantages of employing these modes were analysed by drawing examples from various countries.

Finally, an in-depth discussion was provided, focusing on the importance of offsets as a tool for enhancing industrialisation and promoting technological capability in developing countries. Differing perspectives were provided as to whether offsets have worked by drawing examples from various developed and developing countries seeking to achieve economic development through offsets. There is a widespread view that offsets can act as a catalyst for defence industrialisation, technology indigenisation, skills development, employment, licensing, creating sub-contractors, joint ventures, and long-term industrial collaboration. However, the majority of studies to date have provided empirical evidence in relation to the development experiences of only developed countries. Moreover, the empirical evidence is both anecdotal and vague. This study attempts to close this gap by analysing the effectiveness of offsets in a developing country, namely, Malaysia. The study analyses the innovations, sub-contracting work, joint-ventures, licensing, skill development and dual-use technology through offsets in Malaysia.

References and Notes

[1]Freeman Dyson, *The Sun, The Genome and the Internet: Tools of Scientific Revolution,* (Oxford University Press, New York, 2005), pp. 34-37.

[2]J Gill and P Johnson, *Research Methods for Managers*, 3rd Edn, (Sage Publications, London, 2002), pp. 23-29.

[3] M D Gall, W R Borg and J P Gall, *Educational Research: An Introduction,* 7th Edn, (Longman, New York, 1996) highlights why students should undertake educational research.

[4] Japan's transcendent national goal almost 50 years after the Second World War was industrialisation and economic reconstruction, famously put as *Homo Japonicus* lived to work. See *Financial Times*, 'Japan Must Break With its Past to Prosper Again', 20 December, 2004, 7.

[5] Some economists claim that colonialism and imperialism held back development in developing countries as raw materials and commodities were exported back as input for industrialisation by the colonial masters. However, this was debated by others who claimed that imperialism in some parts of the world brought about structural development such as transportation which expedited development.

[6] Pradip K Ghosh, Ed, *Multinational Corporations and Third World Development,* (Greenwood Press, London, 1984).

[7]Angus Maddison, 'The Assessment: The Twentieth Century-Achievements, Failures, Lessons,' *Oxford Review of Economic Policy*, winter, 1999, 67-79.

[8]Archibugi, Daniele and Jonathon Michie, Eds, *Technology, Globalisation and Economic Performance*: (Cambridge University Press, Cambridge, 1997).

[9] R B Sutcliffe, *Industry and Underdevelopment*, (Addison-Wesley Publishing Company, Oxford, 1971); Uma S Kambhampati, *Development and the Developing World,* (Blackwell Publishing Ltd, Oxford, 2004); A Hamsden, *Asia's New Giant: South Korea and Late Industrialisation.* (Oxford University Press, New York, 1989); P K Ghosh, Ed, *Multinational Corporations and Third World Development,* (Routledge, London, 1984); R Jenkins, *Transnational Corporations and Uneven Development*: *The Internationalisation of Capital and Third World*. (Routledge, London, 1991); R Kiely, *Industrialisation and Development,*(UCL Press, London, 1998); Sanjaya Lall, Ed, *Transnational Corporations and Economic Development,* (Routledge, London, 1993).

[10] See T Allen, and A Thomas, Eds, *Poverty and Development in the 21st Century*, (Oxford University Press, Oxford, 2001); See also Yujiro Hayami, *Development Economic*, (Oxford University Press, New York, 1997) p.212; Uma S Kambhampati, *Development and the Developing World,* (Blackwell Publishing Ltd, Oxford, 2004), pp.12-15; Diana Hunt, *Economic Theories of Development: A Competing Paradigm,* (Harvestor Wheatsheaf, Hertfordshire, 1989); H B Chenery, and M Syrquin, *Patterns of Development, 1950-1970,* (Oxford University Press, New York, 1979); M Edward, How Relevant is Development Studies?, *In*: F Schuurman, Eds, *Development Research: From Impasse to a New Agenda:* (Zed Books, London, 1993).

[11] Diana Hunt, *Economic Theories of Development: A Competing Paradigm,* (Harvestor Wheatsheaf, Hertfordshire, 1989), p.1-5.

[12] Michael Todaro P**,** 2nd Ed, *Economic Development in the Third World***,** (Longman House, Essex, 1981) p.8; See Hayami Yujiro, *Development Economics: From the Poverty to the Wealth of Nations,* (Clarendon Press, Oxford, 1997); Irma Adelman, *Theories of Economic Growth and Development,* (Stanford University Press, California, 1961), p.1; Gerald Meier, *Leading Issues in Economic Development: Studies in International Poverty*, (Oxford University Press, Oxford, 1970), p.7 for further discussions on definition to economic development and growth. Indicators of development include the role of capital formation, Balance of payments, planning, re-emerging and expansion of agricultural

production, role of government, economic infrastructure, transportation, and social infrastructure, such as schools, hospitals, sewers, water supplies and capital formation.

[13]See also H Myint, *Economic Theory and the Underdeveloped Countries*, (Oxford University Press, London, 1971); P A Baran, On the Political Economy of Backwardness, *In*: A N Agarwala and S P Singh, Eds, *The Economics of Underdevelopment*, (Oxford University Press, New Delhi, 1975), pp. 41-91.

[14]According to Todaro, political economy is concerned with the relationship between politics and economics-with special emphasis on the role of power in economic decision making. See Michael Todaro P, 2nd Edn, *Economic Development in the Third World*, (Longman House, Essex, 1981).

[15]Michael Todaro P, Smith Stephen C, *Economic Development*, 9th Edn, (Pearson Ltd, London, 2006), p. 23.

[16]The United Nations Industrial Development Organisation (UNIDO) indicated multiple correlations comparing the level of industrialisation with a number of candidate variables: per capita income, population as an approximation for size of market, the rate rather than the level of economic development, government policy, natural resource endowment, trading positions, technological factors and other factor such as availability of technical and entrepreneurial skills, and the relative cost of labour and capital.

[17] World Bank, *Data on Country Class Groups*, [online], (World Bank, Washington, 2005), (Accessed: 11 January 2005),
Available at: http:// www.worldbank.org/data/countryclassgroups.htm dated 11 January 2005.

[18] R B Sutcliffe, *Industry and Underdevelopment*, (Addison-Wesley Publishing Company, Manila, 1971), p.3.

[19] H Tom, D Johnson and Hand Weild, Eds, *Industrialisation and Development*, (Oxford University Press, Oxford, 1996), p.42.

[20] R Kiely, Industrialisation *and Development*, (UCL Press, London, 1998), p.17.

[21] The structure of manufacturing has always followed a uniform pattern. The food, textile, leather and furniture industries- which we define as the “consumer goods industry” always develop first during the process of industrialization. The metal-working, vehicle building, engineering and chemical industries - the “capital goods industries” soon develop faster than the first group. This can be seen throughout the process of industrialization. Eventually the ratio of the net output in the consumer-goods industries continually declines as compared with the net output of the capital-goods industries.

[22] See R B Sutcliffe, *Industry and Underdevelopment*, (Addison-Wesley Publishing Company, London, 1971), p.18; A Gerchenkron, The Typology of Industrial Development as a Tool of Analysis, *In: Continuity in History*,(Cambridge University Press, Cambridge, 1965), pp. 17-18.

[23] Ibid, p.19.

[24] J Elliott, *An Introduction to Sustainable Development*, (Routledge, London, 1994), pp.12-14.

[25] J Sachs, International Economics: ‘Unlocking the Mysteries of Globalisation’, *Foreign Policy*, 110, 1998, 97-111.

[26] See G Feder, R E Just and D Zilberman, *Adoption of Agricultural Innovation in Developing Countries: A Survey*, *Economic Development and Cultural Change*, 3392, 1985, 255-98; K B Griffin, Alternative *Strategies for Economic Development*, (Macmillan, Basingstoke, 1989).

[27] J Elliott, *An Introduction to Sustainable Development*, (Routledge, London, 1994) p.23.

[28] Manufacturing industry can be divided into 3 different stages which include domination of consumer goods in stage 1; capital goods in stage 2; and balance of consumer goods and capital goods industries with a tendency for the capital goods to expand rather more rapidly than the consumer good industry in stage 3.

[29] See P K Bardhan, Alternative Approach to Development Economics, *In*: S T N Chenery and Srnivas, Eds, *Handbook of Development Economics*,1, (North Holland, Amsterdam, 1988), pp.40-71.

[30] See Michael P Todaro, *Economic Developmen*t, 5th Edn, (Longman Group Limited, New York, 1994), pp. 68-92.

[31] See A Chowdhury and I Islam, *The Newly Industrialising Economies of East Asia*, Routledge, London, 1993); R Jenkins, 'The Political Economy of Industrialisation: A Comparison of Latin American and East Asian Newly Industrialising Countries', *Development and Change*, 1992, 197-231.

[32] Ashish Kumar, *The Impact of Policy on Firms' Performance: The Case of CNC Machine Tool Industry in India*, PhD Thesis, Van Wageningen Universiteit, Netherland, 2003; Also see H Chenery, Growth and Transformation, *In*: H S Chenery. Robinson et al., *Industrialisation and Growth: A Comparative Study*, (Oxford University Press, New York, 1986); M Syrquin, Patterns of Structural Change, *In*: H Chenery, and T Srinivasan, Eds, Handbook of Development Economics, Volume 1, (North Holland, Amsterdam, 1988); A Halperin and M Teubal, 'Government Policy and Capability-Creating Resources in Economic Growth', *Journal of Development Economics*, 35, 1991, 219-241.

[33]See E Mandel, *Marxist Economic Theory, 2*, (London, 1968) pp. 476-9.

[34]K S Jomo, S*outheast Asia's Industrialization: Industrial Policy, Capabilities and Sustainability*, (Palgrave, New York, 2001), p.3.

[35] Hong Kong is today a 'Poster Economy' with a Free Port, Low Government Intervention, Minimal Capital Controls and Fair Rule of Law. See *Financial Times*, 'Hong Kong Retains World's Freest Economy Ranking', 16 December 2004, p.7.

[36]See Michael P Todaro, and Stephen C Smith *Economic Development*, 9th Edn, (Pearson Education Lmtd, Oxford, 2006), pp.16-18.

[37]W W Rostow, *The Stages of Economic Growth: A Non Communist Manifesto*, (Cambridge University Press, Cambridge), 1960, p.1.

[38] Ibid, p.1.

[39] Ibid p.3.

[40] Ibid, p.7.

[41] P W Preston, *Development Theory: An Introduction*, (Blackwell Publishers, Oxford, 1997), pp. 175-177.

[42]W W Rostow, *The Stages of Economic Growth, A Non Communist Manifesto***,** (Cambridge University Press, Cambridge, 1960) p.7.

[43] Op cit, p.176.

[44] D E Apter, *Re-thinking the Politics of Modernization, Dependency and Post-Modern Politics*, (CA: Sage Publication, Beverly Hills, 1987); H Bernstein, 'Modernization Theory and the Sociological Study of Development', *Journal of Development Studies*, 7(2), 1971, 141-60; I.Roxborough, 'Modernisation Theory Revisited: A Review Article', *Comparative Studies in Society and History*, 30, 1988, 753-61.

Modernisation theory was put forward by a group of American scholars against the backdrop of the cold war. They provided a theoretical rationale for making economic and technological aid available to the Third World, aid which would then accomplish a political objective, that of keeping these countries non-Communist.

[45]John Toye, *Dilemmas of Development*, 2nd Edition, (Blackwell, Oxford, 1993), pp.8-9.

[46] G Myrdal, *Asian Drama: An Inquiry into the Poverty of Nations, (*Penguin, Harmondsworth, 1968), p. 17.

[47] Referred to a process of development whereby change towards social, political and economic systems that have developed in the west. See H Bernstein, 'Modernisation Theory and the Sociological Study of Development', *Journal of Development Studies*, 7(2), 1971, 147. This confusion can happen when Eurocentrism is equated to westernisation; see J P Nettl, *Political Mobilisation: A Sociological Analysis of Methods and Concepts*, (Faber, London, 1967), p.193; Uma Kambhampati, *Development and the Developing World*, (Blackwell Publishing Ltd, Cambridge, 2004), pp. 70-72.

[48] H Myint, *Economic Theory and the Underdeveloped Countries*, (Oxford University Press, London, 1971), p.4.

[49] M Nash, *Unfinished Agenda: The Dynamics of Modernisation in Developing Nations*, (Boulder CO: Westview, 1984), pp. 53-58.

[50] I Roxborough, 'Modernisation Theory Revisited: A Review Article', *Comparative Study in Society and History*, 1988, 30, 753-61.

[51] D Apter, *Re-thinking Development: Modernisation, Dependency and Post-Modern Politics,* (CA: Sage Publications, Beverly Hills, 1987), pp 73-77.

[52] Ibid, pp.73-77.

[53] Prebisch was a key figure in the UN Economic Commission for Latin America (ECLA) which was founded in 1948, and made an important contribution to the early development work of the UN through helping to set up the first UNCTAD in 1964.

[54] The Ricardian theory suggested that each country have a specific set of local resources, a natural endowment of material, cultural and geographical opportunities, and that a country's economic development would benefit from specialisation of these particular strengths coupled to widespread international trade.

[55] R Prebish, 'The Economic Development of Latin America and its Principal Problems', *Economic Bulletin of Latin America,* VII: 1, February, 1962.

[56] H Singer. Thirty Years of Changing Thoughts on Development Problems, In: Hanumantha C Rao and P Joshi, Eds, *Reflections on Economic Development and Social Change,* (Allied Publishers, London, 1979).

[57] Op.cit, pp.14-18.

[59] P W Preston, *Development Theory: An Introduction*, (Blackwell Publishers, Harlow, 1997), pp.182-188.

[60] Michael P Tadaro, Economic Development, 5th Edn, (Longman Group Limited, New York, 1994), pp. 68-92.

[61] See Andre Gunder Frank, *Capitalism and Underdevelopment in Latin America*, (Monthly Review Press, New York, 1983), p.355; S Smith, **'**The Ideas of Samir Amin; Theory of Tautology', *Journal of Development Studies*, 17 ,1980, S Smith and J Sender, **'**A Reply to Samir Amin'**,** *Third World Quarterly,* l.5(3), July, 1988, 650-6; F H Cardoso**, '**Dependency and Development in Latin America', *New Left Review***,** 34, 1983, 83-95.

[62] This issue was raised by the Economic Commission for Latin America, a group which undertook to examine the reasons for differences of achievements between the developed core and developing periphery.

[63] Furtado argues the need for industrialisation as creating a superior way of life; rich countries are believed to be rich because they are industrialised; and poor countries are believed to be poor because they are producing agricultural products. See C Furtado, *Development and Underdevelopment,* University of California Press, Berkeley, 1964).

[64]See Rosenstein-Rodan, 'Problems of Industrialisation of Eastern and South-Eastern Europe", *Economic Journal,* June-September, 1943; R Prebish, 'The Economic Development of Latin America and its Principal Problems', *Economic Bulletin of Latin America,*VII(1), February, 1962; R Nurkse, *Problems of Capital Formation in Underdeveloped Countries*, (Blackwell, Oxford,1953); A Hirschman, *The Strategy of Economic Development,* (Yale University Press, New Haven, 1958); G Myrdal, *Economic Theory and Underdeveloped Countries*, (Blackwell, Oxford, 1957), pp. 28-35.

[65]According to this theory, an industry may be temporarily given support to compensate for a cost disadvantage it has *vis-a-vis* established as a result of its later start. The early starter is a more efficient producer than late starters as it has learned by doing. Without support, new suppliers will not be able to enter the market successfully with the early starter, and a situation of imperfect competition may be perpetuated.

[66]C Furtado, *Development and Underdevelopment,* (University of California Press, Berkerly, 1964), pp. 63-65.

[67]Ibid, pp 63-65; Also see P Baran, The Political Economy of Growth, (Monthly Review Press, New York, 1957).

[68] Core states are the advanced industrial states, mainly the Organisation of Economic Cooperation and development (OECD) countries. The periphery states include those states of Latin America, Asia and Africa which rely heavily on agricultural export for foreign exchange earnings.

[69] G Myrdal**,** *Economic Theory and Underdeveloped Regions*, (Methuan, London, 1964), pp. 27-29.

[70] P Baran, *the Political Economy of Growth*, (Monthly Review Press, New York, 1957), p.28.

[71] P W Preston, *Development Theory: An Introduction*, (Blackwell Publishers, Harlow, 1997), pp.190-195.

[72] S Lall, 'Is Dependence a Useful Concept in Analysing Underdevelopment?' *World Development*, 3(11), 1975, pp.799-810.

[73] Ibid, p..803.

[74] See John Williamson, What Washington Means by Policy Reform, *In*: John Williamson, Ed, *Latin American Adjustment: How much has Happened?* (Institute for International Economics, Washington D.C, 1990); John Williamson, 'What Should the World Bank think about the Washington Consensus', The World Bank Research Observer, 15(2), August, 2000, 251-64.

[75] P W Preston, *Development Theory: An Introduction*, (Blackwell Publishing Ltd, Oxford, 1996), pp. 190-195.

[76] D Booth, Ed, *Rethinking Social Development*, (Longman, London, 1994).

[77] D C Mowery and N Rosenberg, *Technology and the Pursuit of Economic Growth*, (Cambridge University Press, Cambridge, 1989), pp.45-48.

[78] C Leys, *The Rise and Fall of Development* Theory, (James Currey, London, 1996), p.28.

[79] See World Bank, *East Asian Miracle: Economic Growth and Public Policy*, (World Bank, Washington D.C, 1993); Also see Kazumi Goto, 'Some Thoughts on Development and Aid: Japan's Strategic Response,' *OECF Journal of Development Assistance*, 3(1), 1997, 18.

[80] See Joseph Stigtlitz, 'Redefining the Role of the State-What Should it Do? How Should it do it? And How Should the Decisions be Made?' (MITI Research Institute, Tokyo, March, 1998).

[81]Michael P Tadaro, *Economic Development*, 5th Edn, (Longman Group Limited, New York, 1994), pp. 68-92.

[82] Op cit, p. 72.

[83] Sanjaya Lall, 'Symposium on Infant Industries' *Oxford Development Studies*, 31(1), 2003, 14-20; Robert, Wade 'Symposium on Infant Industries' *Oxford Development Studies*, 31(1), 2003, 8-14.

[84]H J Chang, *the Political Economy of Industrial Policy*, (Macmillan, London and Basingstoke, 2002), pp. 14-21.

[85] H B Chenery and M Syrquin, *Patterns of Development*, 1950-1970, (Oxford University Press, New York, 1975), pp. 63-68.

[86] See D Seers, The Stages of Economic Growth of a Primary Producer in the Middle of the 20th Century, In: R I Rhodes, Ed, *Imperialism and Underdevelopment*, New York, (Monthly Review Press, 1970), pp. 163-80.

[87] H Singer, 'Industrialisation: Where do we stand? Where are we going?' *Industrialisation and Development*, 12, 1984, pp. 79-88.

[88] K B Griffin, and J L Enos, *Planning Development*, (Addison Wesley, London, 1970).
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[89] Op cit, pp. 83-85.

[90] J Wade 'Knowledge in a Box', *Chief Executive*, 63, 1990, pp. 44-47.

[91] Ibid, p.49.

[92] H B Chenery and Elkington, *Structural Change and Development Policy*, (Oxford University Press, Oxford, 1979).

[93] D Lall, *The Poverty of Development Economics*, (Hobart, London, 1983).

[94] Pradip K Ghosh, *Industrialisation and Development: A Third World Perspective*, (Greenwood Press, UK, 1984), pp.17-28.

[95]B Balassa, *The Newly Industrialising Countries in the World Economy*, (Pergamon Press, London, 1981), p.12.

[96]See H Linnemann, Ed, *Export-Oriented Industrialization in Developing Countries,* (Singapore University Press, Singapore, 1987); also see B. Balassa, *The Newly Industrialising Countries in the World Economy,* (Pergamon Press, London, 1981), p.12.

[97] H Linnemann, Ed, *Export-Oriented Industrialization in Developing Countries,* (Singapore University Press, Singapore, 1987); pp.14-16

[98] Ibid, pp.44-49.

[99] Ibid, pp.44-49.

[100] Industrial cluster include a population of economic agents-firms as well as individuals with specialised skills or knowledge relevant to the linked activities that are carried out.

[101] M Chen, Weley Richard Nelson and John Walsh, 'Appropriability Conditions and Why Firms Patent and Why They do Not in the American Manufacturing Sector', *Unpublished paper presented at OECD,* June 1996; J Jenkins Craig T Leicht Kevin and Author Jaynes, 'Do High Technology Policies Work? High Technology Industry Employment Growth in U.S', *Social Forces*, 85 (1), September, 2006, 267; Also see A Goldstein, Harvey and S Catherine Renault, 'Contributions of Universities to Regional Economic Development: A Quasi-Experimental Approach.', *Regional Studies*, 38, 2004, 73-746.

[102] Michael Porter, *Competitive Advantage of Nations,* (Simon & Schuster Inc, New York, 1990), pp. 73-77.

[103] Key capabilities here include manufacturing, product design and research and development.

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Chapter 3

3. OFFSETS AND DEFENCE INDUSTRIALISATION

3.1 Scene Setting

Offsets thrive in contradiction: at one end of the spectrum, offsets are recognised as a tool for economic development contributing to technological and industrial growth. On the other hand, offsets are held to be in opposition to a free market approach, encouraging corrupt practices, market distortion and cost inefficiency.[1] The truth, however, lies somewhere between the two extremes. Offsets, fifty years ago were a complex blend of national pride, budget concerns, domestic politics and Cold War industrial policy. Offsets, at that time, were perceived as a tool to relieve economic deprivation.

At the end of the Second World War nation states were confronted with varieties of problems including domestic economic disarray and international trade crises. During this period, the US became concerned about the Soviet Union's military capabilities and decided to offer offsets to its allies as a means of increasing their allies' industrial capability and modernise as well as standardising military equipment between the allied forces. Offsets practices, which began in the late 1950s, especially amongst NATO members, were clearly aimed at promoting US weapons systems and fostering the reconstruction efforts of US allies.

This strategy changed in the 1960s and 1970s when a large number of industrialised Western European countries, recognising the increasing costs of advanced technology, began to demand offsets to maintain their defence effectiveness. Governments of these countries wanted to justify the huge outflows of foreign currency through military purchases by returns in the form of economic development. Eastern European and other developing countries slowly emulated Western offsets practices aimed at raising their defence and economic capabilities. On the civil side, commercial offsets development can be traced back to the 1970s with the changing face of global industrial competitiveness. Today, offsets have gained prominence not only among developed countries but increasingly among developing ones. There are a number of reasons for the increased importance of offsets. [2]

The end of the Cold War has left a security vacuum. There was a global reduction in defence spending, causing a massive dent in the growth and progress of defence industry. Developing countries re-prioritised their national budgets by reducing defence spending and reallocating spending into other sectors of development. Much defence spending was now focused on defence modernisation programmes to upgrade and equip Armed Forces with the latest state-of-the-art-technology.

On the whole, it became a buyers' market. The shrinking defence market, rising equipment costs, increasing demand on 'value for money' and the uncertainties of future defence procurement forced multinationals to pursue market consolidation to become internationally competitive. Against this background, defence contractors had to offer additional incentives, such as offsets, to stay competitive within the defence market. In the 21st century, offsets transactions have continued to grow, featuring as a key ingredient in the arms trade.[3]

Given the fact that offsets are normally tied to arms sales, they are surrounded by complex processes, clouded by secrecy and non-transparent data, and are highly sensitive. Offsets are complex and do not have common international practices applicable across the board. Offsets practices around the world vary in terms of objectives, requirements, strategies and processes. It is also strange that certain countries appear to be more successful than others in their offsets strategies. For the purchasing countries, offsets are often seen as a perfect solution for penetrating the defence sector which is still highly protected by market barriers, patents, intellectual property rights, controlled technology transfers and oligopolistic market structures. Against this backdrop, the primary objective of this chapter is to critically discuss the theory and practice of offsets. This chapter also focuses on the role and impact of offsets towards defence industrialisation with references to both developed and developing countries.

Section 3.2 discusses the components of countertrade. Offsets, a sub-category of countertrade have been characterised as comprising a pool of contradicting definitions. Section 3.3 discusses the reasons for offsets, both from the buyer and seller perspectives. This section provides examples of why offsets were undertaken by certain nations. Section 3.4 examines the policy, process and implementation of offsets. The entire offsets management process, including the role of offsets as part of procurement processes, is explored. This provides an understanding of how offsets fit into the wider function of procurement. Section 3.5 of this chapter examines the challenges faced in the implementation of offsets. This section mainly traces and analyses the undercurrents and complexities that often arise in offsets practices. Section 3.6 explores offsets success factors. The success of offsets depends on a purchasing government's offsets strategy, policy and implementation approach; the defence suppliers' commitment, indigenous corporate strategy and human resource development, and finally the technological absorption capability of the local sub-contracting base. Section 3.7 critically examines the role of offsets and its impact on defence industrialisation by reference to countries which have used offsets to develop their defence industrial base. Section 3.8 closes the chapter.

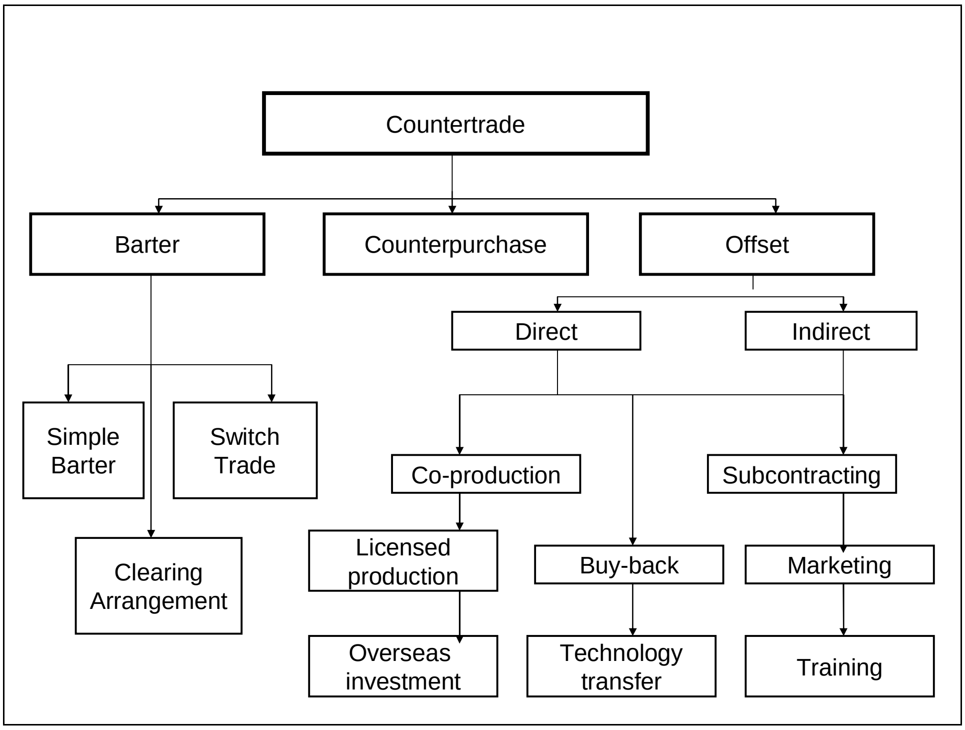
3.2 Components Countertrade

Academicians and practitioners often find it difficult to define offsets. Offsets are complex, muddled with terminologies, complicated tools, formulas and contradictory practices, but offsets are also unique as they create strategic and economic opportunities. Offsets fall under the umbrella term of countertrade. Figure 3.1, below, explains in detail the various components of countertrade. Generally, countertrade is divided into three broad categories of barter, counterpurchase and offsets; barter eschews the use of money while counter-purchase and offsets impose reciprocal commitments.[4]

3.2.1 Barter

Barter can be divided into simple barter, clearing arrangements and switch-trade. The earliest countertrade activity was mainly in the form of simple barter. This practice existed for a long time and flourished during the great depressions of the 1930s, an era when governments and industry faced difficulties in paying for their imports and financing their exports due to exchange restrictions, large debts and low foreign exchange currency reserves. Simple barter is a simultaneous exchange of one item for another. The essence of this transaction is the exchange of goods without the use of currency. This primitive mode of business transaction under imperialistic policies fostered a tight system of colonial dependency on protected markets and captive sources of raw materials. Simple barter was popular until end of the Second World War when a 'truly moneterised world economy' was established[5]. Barter amongst all forms of countertrade was the most popular mode of transaction until the end of the Second World War.[6]

Figure 3.1: Components of Countertrade



Source: Johan van Dyk, Denel Pty Ltd, Introduction to Offsets, *In:* 2001 *Offsets Workshop*, *Civil Service Golf Club*, *Kuala Lumpur*, *July 2001*, (Ministry of Defence, Malaysia, 2001), (with permission).[7]

When a number of barter transactions are grouped together under a single contract, whereby each party agrees to purchase a specified (usually equal value) amount of goods and services, the arrangement is known as a 'Clearing Arrangement'. Most of such transactions are accomplished on a government-to-government basis, in which each country sets up an account that is debited whenever one country imports from the other. This form of transaction is very popular amongst Third World countries which lack foreign currency or face difficulties with cash transactions. The account is cleared on an annual basis to remove imbalances.[8] The third type of barter is switch trade. Switch trade is more flexible as it allows a country to exchange with a third party (hard currency or another product) credits accrued under a clearing arrangement.[9]

3.2.2 Counterpurchase

The second mode of countertrade transaction is counterpurchase. Counterpurchase is an agreement whereby the initial exporter buys or undertakes to find a buyer for a specified amount or value of unrelated goods from a set list determined by the buyer, during a specified time period and to the value of the initial export. The value of the counter-purchase goods is an agreed percentage of the price of the goods originally exported. This type of transaction is the most widely used of all countertrade options. Counter-purchase usually occurs between an advanced country and a developing country and is found particularly in key industrial sectors. Defence companies tend to avoid counter-purchase agreements because they inevitably incur extra transaction costs.[10] In addition, many counterpurchase agreements impose quite rigid specifications relating to the time for completion of the counter purchase and penalties for non-performance.[11]

3.2.3 Offsets

Offsets, the third mode of countertrade, have become increasingly popular, especially in the international defence trade in recent years. Offsets have been subject to various definitions, meaning different things to different people. Below are a few examples of offsets definitions:

i. '….an offset is a contract imposing performance conditions on the seller of a good or service so that the purchasing government can recoup, or offset, some of its investment. In some way, reciprocity beyond that associated with market exchange of goods and services is involved.'[12]

ii. '… an offset occurs when the supplier places work of an agreed value with firms in the buying country, over and above what it would have bought in the absence of the offsets.'[13]

iii. 'Offsets are simply goods and services which form elements of complex voluntary transactions negotiated between governments as purchasers and foreign suppliers….. They are those goods and services on which a government chooses to place the label *offsets*.' [14]

iv. 'Offsets, co-production, barter and countertrade are compensatory trade agreements that incorporate some method of reducing the amount of foreign exchange needed to buy a military item/some means of creating revenue to help pay for it.'[15]

v. Offsets are 'compensatory procurement arrangements designed to offset the cost of purchasing defence equipment from overseas by means of a reciprocal (countertrade) commitment by suppliers in support of a purchaser's domestic economy.'[16]

vi. Offsets often appear under the guise of compensation packages, industrial benefits programmes, cooperative arrangements and countertrade policy.[17]

These various definitions appear to offer a common understanding that offsets are a form of compensatory or reciprocal trade agreement between private companies of seller countries and governments of buyer countries in the arms trade. The term 'reciprocity' stresses the mutual agreement between sellers and buyers to enter into offsets transactions. Some countries view offsets as implying partnership and cooperation. However, implicitly there is a more cynical view of schemes that see offsets as intending to force relocation of activity from the supplier country to the purchasing nation.[18] Offsets are even seen as a form of coercion.[19]

Offsets relate to any normal 'reciprocity transactions' and are not limited to defence or government imports. Offsets have become a widespread practice both in the civilian aircraft industry as well as in the aerospace/defence sector. Offsets recipients look for *additionality*[20] and *causality*[21] in offsets arrangements. Causality relates to establishing the fact that projects would not otherwise materialise without offsets. Additionality refers to projects that are new to the buyer country and must create new opportunities such as of employment, technology and skills development.

Countries often differ in their interpretation of offsets. Some countries tend to use offsets as a subset of countertrade and vice-versa. The US, for example, does not favour the term offsets as it is said to be a politically incorrect word, implying barriers to free market enterprise and liberalisation. The US prefers to use the term *Industrial Participation* rather than offsets. The US defines offsets as a condition that a foreign government often negotiates with a US company seeking to export a major defence or commercial system to its country, under which the country's firms: i) participate in the production of the system and/or its subsystems, or ii.) obtain other technological or economic benefits from the US exporter.[22] Often direct offsets are mandatory and US companies should be given the opportunity to be directly involved in the technology development and production of the equipment or sub-systems purchased. To define offsets, a detailed classification of offsets types is offered by the United States Bureau of Export Administration (BEA) is shown in Table 3.1, below.

The UK also uses Industrial Participation as the term to describe its offsets activities, being purely based on work generated within the UK by offshore vendors. South Africa uses the term National Industrial Policy (NIP) to relate to non-defence related offsets and Defence Industrial Participation (DIP) to relate to defence offsets. Malaysia uses countertrade as the umbrella term for a spectrum of activities including offsets and counterpurchase. Other terms used to define offsets include Industrial Enhancement, Industrial and Regional Benefits Policy and Industrial Cooperation.[23] Variation in the usage of offsets amongst countries may be interpreted as implying differing strategies. It is almost impossible to have one universal definition for offsets as the subject is *'not a one size fits all'*. Offsets can be further divided into direct and indirect offsets.[24]

3.2.4 Direct Offsets

Direct offsets are contractual agreements that involve defence products and services referenced in the sales agreement for military exports. These transactions are directly related to the defence items or services exported by the defence firm and are usually in the form of co-production, subcontracting, technology transfer, buy-back, joint-ventures, marketing assistance, training, production, licensed production or financial assistance. Countries like the UK, the US, Singapore and South Korea adopt this interpretation. Others, such as Malaysia, South Africa and Portugal, include all defence-related activities as direct offsets. Each activity is explained in detail below.

Co-production permits a foreign government or producer to acquire the technical information to manufacture all or part of a defence item domestically. Co-production can be either government-to-government agreements or between a government and a private manufacturer. Co-production includes government-to-government licensed production, but excludes licensed production based upon direct commercial arrangements by prime manufacturers. On the other hand, *licensed production*, a commercial arrangement, involves the manufacture of a whole system or just components of the system using the supplier's technology in the buyer's country. This must, however, be done with the permission of the supplier government. The quantity of the items to be manufactured can be a proportion of all its orders, including exports.

Table 3.1: Types of Offsets according to United States Bureau of Export Administration

Offset term	Definition
Direct offsets	Contractual arrangements that involve defence articles and services referenced in the sales agreement for military exports.
Indirect Offsets	Contractual arrangements that involve goods and services unrelated to the export referenced in the sales agreement.
Co-production	Overseas production based upon government to government agreement that permits a foreign government(s) or producer(s) to acquire the technical information to manufacture all or part of a US origin defence article. It includes licensed production based upon direct commercial arrangements by US manufacturers.
Licensed production	Overseas production of US-origin defence article based upon transfer of technical information under direct commercial arrangements between a US manufacturer and a foreign government or producer.
Technology Transfer	Transfer of technology that occurs as a result of an offset agreement and that may take the form of research and development conducted abroad; technical assistance provided to the subsidiary or joint venture of overseas investment; or other activities under direct commercial arrangement between the US manufacturer and a foreign entity.
Overseas Investment	Investment arising from an offset agreement, often taking the form of capital dedicated to establish or expand a subsidiary or joint venture in the foreign country.
Credit Value of an Offset	The offset transaction value applied against the offset agreement, which may be greater that the actual value of the offset. Extra credit (that is, through multipliers) is sometimes earned as an incentive to perform some specific offset, such as investment or technology transfer of particular interest to the foreign government.

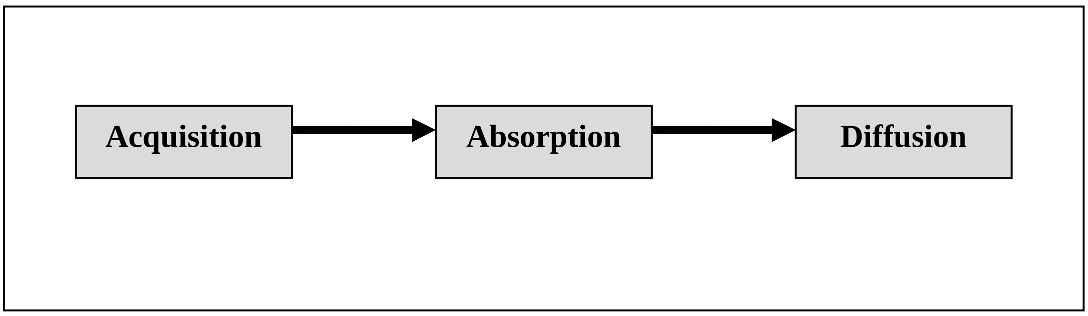
Source: The United States Department of Commerce, *Ninth Offsets Report*, [online], (Bureau of Industry and Security, Washington, 2006), (Accessed: 7 June 2004), Avialable at: http://www.bis.doc.gov/defenceindustrialbaseprograms/index.htm, p.11

The technology transfer contemplated can include both product and process technology, with the presumption that the buyer's defence industrial capacity is fairly well developed to be reasonably able to absorb the transfer. Both, co-production and licensed production, however, takes into consideration issues such as unit costs, lead times and equipment costs.

Subcontractor production is a straightforward overseas production of parts or sub-systems of a wider defence system. It does not necessarily involve licensing of technical information and is usually a direct commercial arrangement between the defence prime contractor and a foreign producer. This is one of the less desirable forms of offsets for a country to negotiate, as it comprises little transfer of technical knowledge. Buy-back arrangements can be more costly as it involves the exporter agreeing to purchase products from the importer. In this case, the seller transfers technology (embodied in plant and equipment) and agrees to buy a proportion of the output over a specified period of time. The buyer will borrow money and pay the seller for the plant. Buyers will then use the proceeds of the sales to repay the hard currency which was borrowed to purchase the equipment. Buy-back involves precise particulars of the products to be bought, the amount, type and delivery periods.

Technology transfer is highly prized and considered to be one of the most valuable benefits of offsets.[25] Technology transfer can be in the form of research and development, technical assistance and training, or patent agreements between manufacturers. For many developing countries, technology transfer forms an essential part of their offsets arrangement. The US Department of Commerce in its 9th BIS Report defined technology transfer as including research and development conducted abroad, exchange programs for personnel, data exchanges, integration of machinery and equipment into a recipient's production facility, technical assistance, education and training, manufacturing know-how, licensing and patent sharing.[26]

Figure 3.2: Technology Transfer Process



Source: Author

The technology transfer process shown in Figure 3.2 involves three stages: acquisition, absorption, and diffusion. The local commercial and defence industry learn and assimilate technologies that are transferred through offset arrangements and fully capitalise on such technologies by, first, replication, and then introduction of upgrades and finally independent innovation as a foundation for global competitiveness. Investments of this form usually involve a joint venture arrangement, though output from an independent manufacturer may be used in lieu of cash dividends in computing compensation. It is a way for the buyer to increase investment, create jobs, and stimulate the domestic economy, contributing towards domestic economic development.

3.2.5 Indirect Offsets

In contrast to direct offsets, indirect offsets are contractual arrangements that involve defence or civil goods and services unrelated to the exports referenced in the sales agreement. These transactions are not directly related to the defence items or services exported by the defence firm. The kinds of offsets that are considered ‘indirect’ include purchases, investment, training, financing activities, marketing/exporting assistance and technology transfer. The varying definitions used by nations to define offsets activities determine a particular country’s offsets strategy.

For the purpose of this study, offsets are defined from a developing country’s perspective. In this case, offsets are defined as an economic compensation package whereby the buyer gets a return for the equipment purchased. Direct offsets relate to defence and indirect offsets relate to non-defence.

3.3 Why Pursue Offsets?

The reasons for pursuing offsets can be looked at from two different angles - from the buyer’s perspective and the seller’s perspective. For buyers, offsets act as a mechanism to leverage economic development from contractors. As the purchase of military equipment involves huge expenses which are not normally directly reflected as beneficial to the society (as opposed to health or education) purchasing countries thus view offsets as an excellent tool to justify military expenditure. They normally highlight the beneficiaries' economic returns in terms of jobs, investments, enhanced industrialisation and foreign exchange savings. On the other hand, suppliers view offsets as a marketing tool that can give them the edge to compete for business within a competitive defence market. The following section examines in detail why buyers and sellers pursue offsets.

3.3.1 Defence Industrial Base

Most buyer nations see offsets primarily as a mechanism for both enhancing their defence industrial base, pursuing other economic goals. Governments of buyer nations exercise a certain degree of leverage over the defence contractors to obtain various macro economic benefits, such as employment and the economic growth of domestic defence and non-defence industries. Offsets are also said to provide access to new commercial opportunities through international marketing expertise provided by offsets providers to buyer nation industries.[27] Buyer nations realise the need to maintain a DIB to provide employment and to utilise the skills of retired Armed Forces personnel. In such instances, offsets are also used as political cover to provide hidden subsidies to indigenous military firms that governments wish to artificially sustain, i.e. the promotion of total or partial self-reliance.[28]

Total self-reliance, however, can be a costly affair for smaller countries which have resource constraints on the availability of well-trained production personnel, scientists and engineers, domestic capabilities, financial resources for huge investments into structural development, as well as economies of scale for in-country consumption.[29] In such circumstances, these countries will aim for self-reliance to an extent where they are able to undertake through-life-support in terms of enhanced logistic support capability and depot-level maintenance of the equipment purchased. This is seen as a way to break away from monopoly prices of spares and support by buyers.

Some countries with additional know-how and capability will go a step further by becoming manufacturers of parts and components for foreign producers of platforms, weapons or weapon systems. In the F-16 programme involving Belgium, Denmark, Netherlands and Norway, for example, the consortium decided to participate in the production of the F-16. Some 40 firms participated in the production of parts and components for the aircraft but these companies were small; their industrial structure was below 'critical mass' and the required capital investment exceeded their financial capabilities. [30]

Nations are at crossroads between specialising in platform manufacturing or the weapons and associated control-units and subsystems. For example, nations with capabilities in electronics may want to specialise in the production of subsystems, leaving platform manufacturing to bigger industry players. Developing countries, especially the Newly Industrialised Countries, with low capabilities in platform manufacturing, do have high capabilities in electronic modules related to control-units and subsystems. These countries may thus specialise in sub-system manufacturing. Therefore, it is important that offsets recipients identify their capabilities and strengths and use offsets to further develop their strengths to achieve competitiveness.[31]

Another strategy might be to request offsets for integration and though-life support of the equipment purchased. Yet another is to be self sufficient to the extent of maintaining the equipment purchased, required to avoid unnecessary delays in the case of emergency or breakdowns of equipments, where buyers are continuously dependant on OEMs for spare parts and the maintenance of equipments purchased. In such instances, buyers normally require offsets to support the equipment, thus building capabilities to become providers for regional markets. Countries, such as the United States, the United Kingdom, Australia, South Korea and India, follow this strategy.

A popular case study of how offsets were used to promote the defence sector is that of South Korea (ROK). The security threat to ROK has prompted greater emphasis on indigenous capability. ROK's objective, as far as possible, has been to use offsets to build a domestic production capability in all systems areas, with sufficient capability to manufacture and export items to other countries.[32] The T-50 jet trainer is most often quoted as an example of the strengthening of ROK's defence industrial base. Under this contract, Korea Aerospace Industries (KAI) was the prime contractor while Lockheed Martin (LM) acted as the main subcontractor. [33] KAI was responsible for the avionics and flight control development, wing production and other technical assistance. LM handled marketing presentations. The initial order of 100 aircraft was made by the Korean Air Force with potential global sales of 600 aircraft. [34] The Korean government funded 70% of the programme costs, KAI provided 17% and LM covered the remaining 13%. [35] The main features of this programme included:[36]

i. ROK's ability to maintain a financial/ budgetary lead with the US suppliers.
ii. Significant technology transfers in all areas of the system from foreign suppliers to domestic Korean manufacturers.
iii. Significant offsets content.

Other Korean offsets projects include UK's Westland Helicopter's technology transfer, the supply of technical assistance, training, tooling provision and supply of raw materials for the manufacturing of Lynx landing gears, nose landing gears and the main landing gears to KIA Machine Tool Co.Ltd. Westland continues to place orders for the manufacture of nose/landing gears and parts from KIA for helicopters for its other customers. Daewoo produces 8 P-3C wings for Lockheed Martin, technology obtained through the ROK navy's P-3C anti-submarine airplane acquisition.[37]

The United Kingdom is another country that utilises offsets solely for the development of its DIB. On the one hand, the UK strongly promotes the virtues of market liberalisation, commercialisation and increasingly 'open trade.' UK defence acquisition policy is based on the notion of best value for money. Nevertheless, the risk of neglecting its home-grown defence industry which might in the long run erode its manufacturing base and strategic capabilities has forced it to develop a rigorous offsets policy called Industrial Participation Policy (IPP) to compensate UK businesses by providing work packages. The 'participatory' element of IPP takes the form of compensatory investment into the UK DIB by overseas vendors officially. The UK government is not seeking to protect its domestic defence industry, *per se*, but to enable local defence companies to bid under open competition for overseas defence contracts. It is envisaged that the winning of such contracts will stimulate higher order, defence-related development and production activities in the UK.[38]

The IPP is based on best endeavours and requires 100% IP value with no multipliers. The IP work, both direct and indirect, requires defence-related work carried out in the UK. Commercial or civil equipmend in a defence application qualifies, so does dual use, namely civil application of defence technologies. DESO monitors the implementation of IPP while the Defence Procurement Agency (DPA) oversees all policy matter pertaining to IPP. The value creation of IPP linked to the UK's DIB has been debated as not bringing in 'high-quality' or innovative work to UK firms.[39] It tends to be merely the assembly of foreign made components within the UK, under license, generating short-term income and not directly advancing manufacturing capabilities.[40]

In the case of Singapore, a small but geo-politically, powerful country, defence offsets were used to develop its DIB primarily for strategic reasons. Singapore's threat perception of its neighbouring countries has made it focus on meeting its Armed Forces' immediate needs. In terms of indigenous arms production and defence industrialisation, Singapore regards potential economic benefits as secondary to the task of bolstering the country's defence capabilities.[41] South Africa has also utilised its offsets credits towards the development of the country's defence industrial base based on the Defence Industrial Participation (DIP) scheme under the Armaments Corporation of South Africa (ARMSCOR), with the aim of creating defence-related business in SA. Other countries, such as Brazil,[42] Argentina, Turkey, and Indonesia have all used offsets to develop their defence industrial base over the years. Indonesia's IPTN undertook licensed production of foreign-designed aircraft including the NC 212 light transport plane from CASA Spain, the NB-105 utility-lift helicopters from Germany's MBB, the NAS-332 Super Puma helicopter from France's Aerospatiale, the Bell 412 helicopter from the US and the co-development of CN-235 transport aircraft with CASA of Spain.[43]

Defence industrialisation involves huge investments that take a long time to obtain returns. These investments include sensitive technologies which are not easily obtainable and are subject to various export regulations and embargoes. Therefore, most countries are not able to pursue a totally self-reliant defence industrialisation strategy. Some smaller countries, such as Portugal, Malaysia and the Czech Republic, adopt a more pragmatic approach when entering into collaborative or joint ventures to develop part of the equipment or components that are vital to the main platform. Offsets in this case are linked to in-country work related to the main equipment purchased or other defence work.

3.3.2 Leveraging for High-Technology

Buyer countries often utilise offsets to leverage the transfer of technology into high technology sectors, such as aerospace and defence, as compared to off-the-shelf purchase.[44] For developing countries, heavily engaged in industrialisation, offsets also fill the gap as a vehicle to obtain technology, thereby avoiding the high cost of 'reinventing the wheel' and as a partnering mechanism for engaging in collaborative development of frontier technological systems.[45] The US Presidential Commission reports that 29% of technologies transferred through offsets have resulted in recipient firms being able to compete in world markets.[46]

3.3.3 Jobs

Offsets are also viewed as a vehicle to bring in employment into buyer countries. Employment here refers not only to work in the high technology sector, but also to simple manufacturing and assembly work. For example, Britain's Westland Company claims that the Apache programme has created up to 3,000 British jobs.[47] In the case of Malaysia, CTRM a composite manufacturing plant in Malacca has secured work for around 1,000 workers through an offsets deal from BAE Systems for manufacturing composite parts for the Airbus series of aircraft as well as for the A400M military transport carrier. [48]

3.3.4 Human Resouce Development

Indirectly, the work provided through offsets may enhance local workforce skills and capabilities. Offsets may increase worker skills due to the exposure to new product requirements. New work orders can create opportunities for locals to acquire skills in new industrial areas while repetitive orders for similar jobs in the long-run could develop and further enhance their skills. In high technology sectors, such as aerospace and defence, offsets may benefit recipient firms in terms of training local manpower in areas of documentation, systematic industrial procedures and facilities management which are crucial in the defence or aerospace sectors. Furthermore, international compliance and certification have won overseas orders for many local companies.[49]

3.3.5 Hard Currency Savings

Offsets provide hard currency savings for buyer countries, especially when the deal involves barter or counterpurchase. Sellers will be forced to either receive goods or services in return for cash. Offsets also bring inflows of capital investment which are crucial for developing countries that are shortened capital. However, the issue here is to ensure that such capital is sourced externally from overseas and not within the buyer's country. If the capital for investment is from the buyer country, this will cause a strain on the existing domestic entrepreneurs who are fighting to obtain capital from the pool of scarce capital resources. Yet, operationally, it is difficult to ensure that capital flows are from external sources.

3.3.6 Marketing

For sellers of defence equipment, offsets are seen as a marketing tool, sustaining competitiveness in the saturated defence market, enabling the sale of defence platforms, weapons and subsystems overseas. Offsets can become an essential element of marketing when dealing with trading partners with a strong preference for countertrade. Offsets may be preferred as it demonstrates long-term interest in the customer and may give an edge when core submissions are equal.[50] Past evidence has shown that offsets can be the deciding factor to win a contract if two companies with equally competitive price and quality of equipment compete on the same international bid.[51] Even in the US, where offsets are not a recognised mode of trade transaction, US defence contractors offer offsets to their customers, afraid of losing business to other suppliers who are heavily engaged in the offsets business.

Large defence multinationals have set up extensive offsets operations, manned by individuals whose work is essentially that of a trading company. These MNCs are engaged in evaluating offsets demands, marketing offsets products, building plants, working with potential foreign suppliers, searching for saleable technologies, training foreign firms, managers and engineers, identifying sources of credit, bargaining with buyers over commitments and performance, as well as trading offsets credits and debits. Companies such as BAE Systems, Rolls Royce, EADS, MBDA, Northrop Grumman and Boeing, have their own in-house offsets specialists who work on offsets deals. Normally, the offsets set-up is part of the marketing division within a business development department. Staffs are trained in-house on the workings of offsets and are prepared using their customer's politico-economic objectives and national development plans.[52] Other smaller companies hire independent consultants or offsets advisors to negotiate on their behalf.

3.3.7 Political Mileage

For sellers, offsets are further viewed as an effective tool earning political mileage for defence contractors by demonstrating that they do not seek short-term benefits through the selling of defence equipment, but intend to establish long term partnerships with buyer countries and their industries. This further assists in cementing a bilateral relationship, on a country-to-country level, creating the potential for future business. Contractors create the trust and commitment in wanting to develop long-term sustainable projects that will assist the economic development of buyer countries. The seller company's track record of long-term commitment is reflected positively in the buyer's order book. The successful offsets projects are seen as establishing a good relationship between sellers and buyers beyond normal business deals. Once the buyer and seller establish their reasons for wanting offsets, both parties will then indulge in initiating offsets into their deals. Buyers will ask to incorporate offsets in the procurement deal whilst sellers will formulate the best possible offsets deal to win the contract. This overall process requires an understanding of offsets policy, process and implementation.

3.4 Overview of Offsets Policy and Management Process

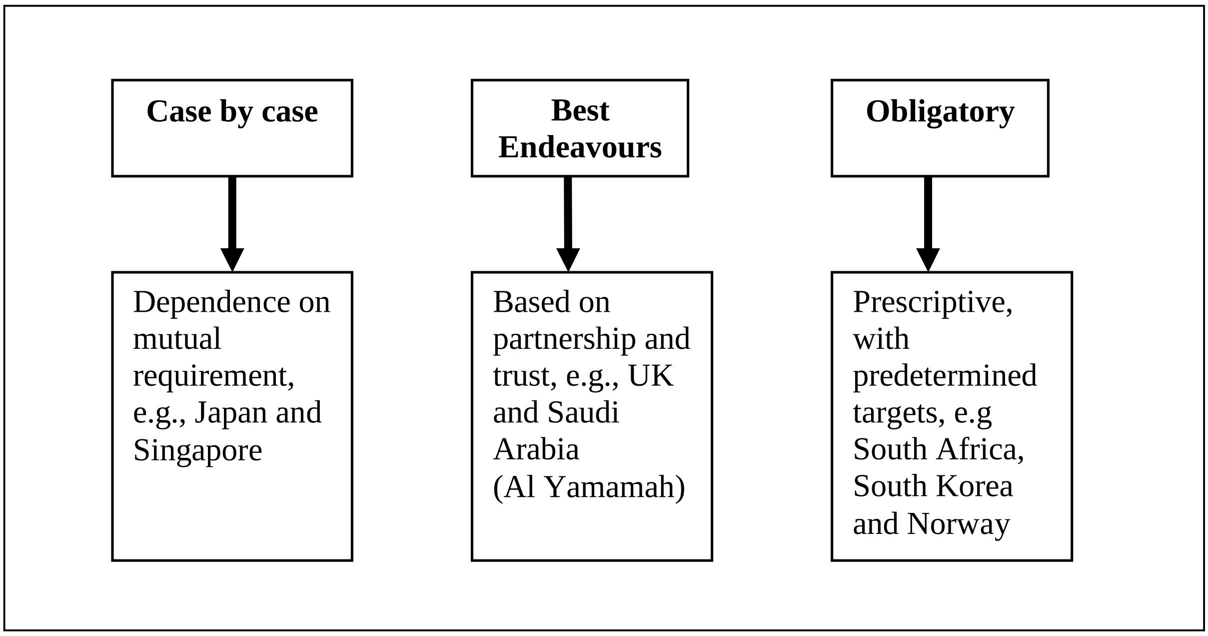
In reality, the 'no one size fits all' condition makes offsets a complex tool to be applied in business practices. There are more than 78 countries around the world with some form of offsets policy.[53] Offsets policy normally outlines the buyer country's offsets objectives and strategy, the various conditions imposed on suppliers, the details of the offsets process, the authority in charge, the implementation procedures and penalties applied. The offsets policies, however, vary in terms of focus and objectives for each country depending on the nation's socio-economic objectives. Many nations have formalised their offsets policy through the publication of guidelines. A dedicated service provider called EPICOS has captured most of these written policies on its website to assist defence contractors and buyer nations in understanding the offsets policies of different countries. However, some countries resort to unpublished guidelines to provide maximum flexibility for negotiations. The overall offsets management process requires producing an offsets policy that includes strategy, process and implementation. The following section provides a general overview in relation to these aspects.

3.4.1 Offsets Strategy

Countries may employ different offsets strategies. The strategy selected will largely depend on the offsets objectives of each nation. Ron Matthews clustered country practices into three different offsets strategies, as shown in Figure 3.3.[54] According to Matthews, the first approach is to use offsets on a case-by-case basis. Japan and Singapore, for example, are more comfortable with this approach, seeking to maximise their benefits though negotiations and compromise.[55]

The second approach is based on 'best endeavours' where offshore vendors are encouraged to offer offsets in return for the sale of goods and services. The UK government takes this approach. The UK MOD believes that the key ingredients for success are partnership, trust and vendor commitment. No penalties are imposed if the vendor fails to achieve the required 100 percent offsets target across the stipulated delivery period. However, non-fulfilment will seriously jeopardise a contractor's chances of winning future bids. It is reported by DESO, the UK offsets authority, that offshore vendors, to date, have kept to their obligations. DESO keeps track of offshore vendor performance which carries weight for future sales.

Figure 3.3: Spectrum of Offsets Policy Possibilities



Source: Ron Matthews, Defence Offsets: Policy versus Pragmatism, *In:* J Brauer and J P Dunne, Eds, *Arms Trade and Economic Development Theory, Policy and Cases in Arms Trade Offsets*, Routledge, London, 2004, p.92.

A third and more rigid approach is where offsets are obligatory and penalties will be imposed on sellers for non-achievement of offset obligations. Normally, a set amount is determined at the outset of the agreement to be mutually agreed between both buyers and sellers. The average penalty is between 5-9% of the contract, and is imposed in the form of a bank guarantee. Penalties have become an increasingly popular approach amongst developing countries. This approach is taken by countries, such as South Africa, Turkey, Poland, the Nordic countries and Malaysia.

3.4.2 Offsets Management Process

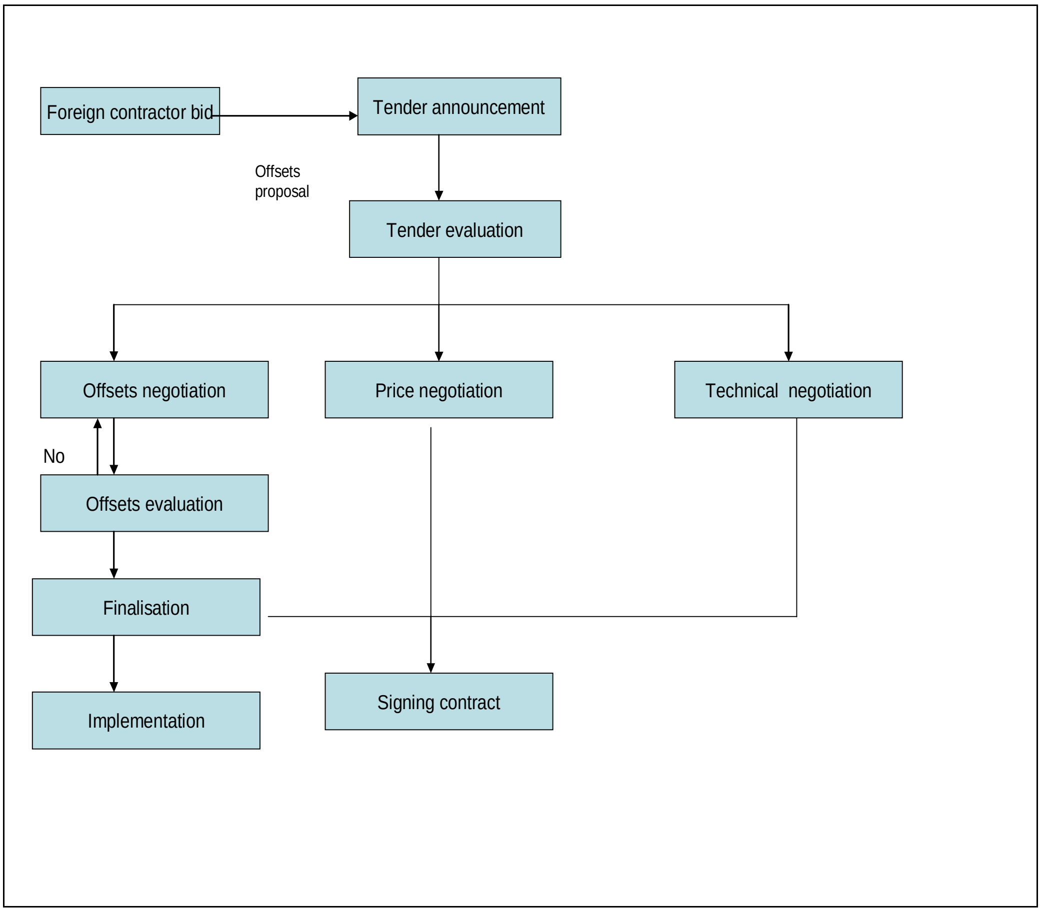
There are several stages to an offsets management process. Figure 3.4 provides an overview of how offsets fit into the overall procurement process. The level and depth of how offsets interface with procurement process may vary for each nation.

For a buyer, once a decision has been made on buying defence equipment, sub-systems or solutions, the Ministry of Defence will then prepare allocations and specifications. In countries where procurement practices are based on free market and competitive tendering, such as in most of the Western European countries, North America and Canada, procurement decisions are based on best value for money. In such instances, offsets recipients are not pre-determined and governments take a hands-off approach towards offsets. Defence contractors are given the option of choosing and working with companies of their choice.

This same system does not apply in many of the developing countries. In such developing countries, procurement decisions are made by the Treasury which will decide whether it should be an open-tender, limited tender or direct negotiation. In most instances, direct negotiations are made on a government-to-government deal, mainly based on political decisions. Once these decisions have been made, the tender document will then be prepared and advertised. The tender document will have requirements on proposal submission, based on several criteria such as a competitive price, superior technical components and attractive offsets packages. Buyer nations have more leverage on demanding quality offsets in an open-based tender as compared to restricted or direct negotiation. This is because suppliers will try their best to put together an attractive offsets package in order to win the contract. The proposal which includes offsets will then be submitted to the MOD procurement division for tender evaluation.

The Tender Board will evaluate various proposals and select the winning defence supplier. The defence procurement team will evaluate and negotiate the equipment price and technical aspects of the equipment while the offsets team will evaluate the merits of the offsets proposal. Once the supplier has been identified, the government and defence contractor will negotiate the details of the contract. A separate negotiation will take place to determine the details of the offsets programme, recipients, implementation schedule and the penalty for non-compliance. During the offsets negotiation process, various offsets attributes such as multilpiers, threshold values, penalties, etc are used to conclude the offsets programmes. These attributes are vital to determine that the buyer country has obtained sufficient offsets, valued at mutually agreeable terms between the seller and buyer. In some instances, when there are disagreements as to the details of the offsets contracts, negotiations can take months to conclude.

Figure 3.4: Offsets Process



Source: author

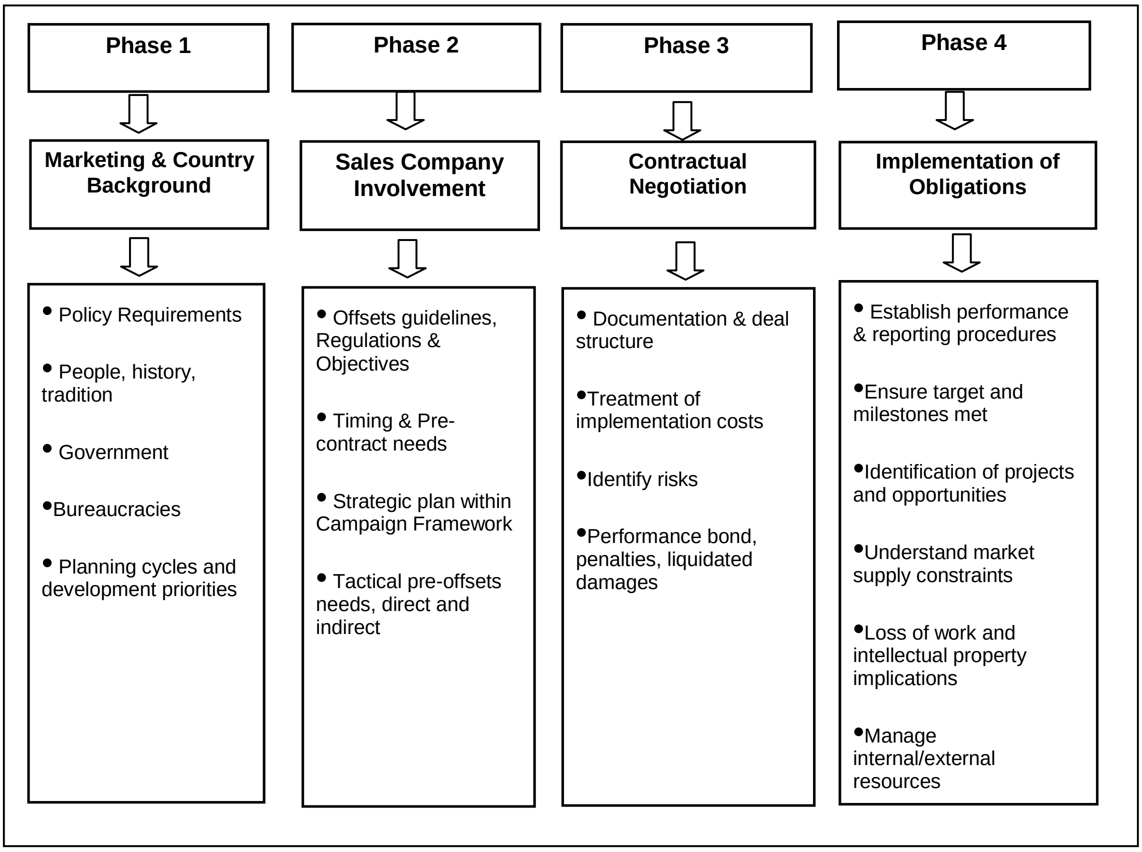
As the offsets proposal is an important component of the overall procurement bid, the seller has to be well-versed in the preparation of a comprehensive and competitive offsets proposal. There are four phases in the preparation of the offsets proposal by the supplier. In the first phase, the supplier company's marketing unit will form a team to study the buyer country's geo-politics and economic background. These include understanding the buyer nation's policy requirements, the people, their history and traditions, their government and its bureaucracies, as well as the planning cycles and development priorities. Further, a survey, including a risk analysis, will be conducted to evaluate the country's economic conditions, industry growth and capabilities. The seller must also be familiar with the buyer nation's defence equipment procedures and offsets rules when preparing a sale.

The second stage will involve a massive sales campaign to promote the defence equipment and the offsets programme proposal to the relevant authorities in the buyer country. This stage will include understanding the offsets guidelines, regulations and objectives, establishing timing and pre-contract needs, developing a strategic plan within the campaign framework, determining tactical pre-offset needs, direct and unrelated, as well as managing and controlling risk, costs and expectations.

The third stage will only occur if the supplier's bid is successful, whereby the supplier company's offsets team will then have to sit down with the buyer nation's government offsets authority to discuss the finer details of the offsets package. This stage will include documentation, finalisation of costs, identification of risk and performance bonds, penalties and liquidated damages.

The fourth and final stage requires that, upon signing of the primary defence contract, as well as the offsets contract, the supplier will need to embark on implementation of the offsets project. The implementation stage will take into consideration the performance and reporting procedures, targets and milestones, identification of projects and opportunities, market and supply constraints, loss of work and intellectual property implications, management of internal and external resources and the possibility of fostering sub-contractor and partnership support. Figure 3.5 below summarises a supplier's four-stage approach to offsets management, as explained above.

Figure 3.5: Four-Phase Approach in the Formulation of an Offsets Proposal



Source: Clive Simeons, Senior Consultant to British Aerospace Plc, Implementation of Offsets, *In: 1999 SMI Offsets Conference, Washington, 21 January 1999*, (SMI Conference, US, 1999).

3.4.3 Offsets Implementation

At the implementation stage, it is vital to understand the various attributes which are included in the offsets policy to ensure smooth implementation. These attributes and how they work need to be understood thoroughly by the negotiating parties of both suppliers and recipients of offsets.

The first of such attributes is offsets value. Most countries like to set a minimum offsets value. Offsets value refers to the percentage of offsets required by a buyer government, valued against the total value of the equipment and services purchased. The minimum value will often vary between countries, ranging between 30-400%. The value is then further divided into direct offsets, indirect offsets, counterpurchase, and so on. The quantum or allocation to each sector depends on the buyer country's objectives. For instance, Poland normally asks for a very high offsets value, up to 200%, which are mainly focused towards enhancing its defence industrial base. Saudi Arabia, on the other hand, often asks for offsets to be used to develop commercial ventures. The UK requires a 100% offsets value channelled wholly into its defence sector.

Multipliers are crucial for countries aiming to attract a certain type of offsets. Multipliers are defined as incentives used by buyer countries to stimulate particular types of offsets activities. Defence contractors will receive additional credits towards their offsets obligations above the actual offsets value by introducing multipliers. In 2005, BIS reported that 83 percent of transactions in Europe did not involve multipliers, 85.5 percent of transactions in North and South America did not use multipliers, and 76.6 percent of transactions in Asia and 87.9 percent in the Middle East and Africa did not use multipliers.[56] This indicates that a large number of countries around the world still do not use multipliers as this practice can distort the actual value of a particular offsets transaction.[57]

Offsets multipliers normally vary from one country to another. Multipliers are given by buyer countries to the offshore vendor depending on the importance of the project concerned. For example, a seller may argue that a project valued at x, be given a multiplier of 4 as the project will bring economic returns four times greater than the initial investment to a buyer country's economy. Offsets multipliers are usually used to attract defence contractors to offer high value added projects that suit buyer country objectives, identifying high priority sectors for offsets work. The BIS Report 2005 states that multipliers were most widely used in overseas investments, training transactions, followed by subcontracting.[58] Most countries tend to award high multipliers for technology transfers into high-tech areas, being investments that can create long-term sustainability and employment. High multipliers are also given to government focused projects. The UK does not employ multipliers, thus all work brought into the country is counted on a dollar-to-dollar basis. Poland, however, has a complex system of awarding multipliers, but is reviewing this practice.

Purchasing countries require that suppliers offer offsets at the determined minimum *threshold value*. The offsets threshold refers to a minimum procurement amount set by buyer governments for sellers to include an offsets package in their sale of goods and services. For example, Malaysia imposes offsets on all purchases above 50,000 Euros, whilst South Africa imposes offsets on all purchases of goods and services above 10,000 USD.

An *Implementation schedule* is often included as part of the offsets agreement. This is to ensure that the seller and buyer mutually agree to a timeframe in which the offsets obligations are to be completed. Normally, offsets obligations are to be completed by the end of the warranty period of the equipment purchased. Sometimes, offsets obligations can be longer than the warranty period. The implementation schedule is crucial to ensure on-time delivery of obligations and the constant reporting of programme progress to the relevant government authority. Projects that do not keep track with implementation schedules, without valid reasons are normally subject to penalties.

Another method used to attract offshore vendor investment is to allow the *banking of credits*. This is where sellers are allowed to 'bank' credits earned through projects done in advance or in anticipation of a sale. Some buyer countries provide such options to sellers. Sellers have two ways of accumulating credits. The first is when they have fulfilled their obligations over and above what has been promised in the contract. The second is when sellers provide offsets projects even before the main contract agreement or before a sale is finalised. However, there is usually a time-frame for the utilisation of these credits, normally within three to five years from the offsets credit accumulation date. The benefit of banking offsets credits is that it enables sellers to run programmes in advance, in anticipation of future sales, and be able to claim for this against existing project. This scheme helps sellers achieve their offsets targets much quicker than waiting for the actual programme to commence.

However, sellers must be careful to clarify with buyer governments projects that can be considered for credits. As for buyers, the banking of credits enables sellers to implement projects even before actual sale. It also allows them to be selective in awarding the credits based on the credibility and long-term sustainability of the programme to buyer countries. Banking of credits is still new to many countries due to their lack of understanding with respect to implementing and monitoring this mechanism. As soon as these offsets conditions have been agreed, both sellers and buyers will agree to either sign a separate offsets contract or to insert offsets as part of the main contract. The contract may be signed before, or after, the signing of the main procurement contract. Sometimes, individual offsets recipients will sign a Memorandum of Understanding (MOU) with the seller, spelling out details of their offsets obligations and workings.

As soon as the agreement has been signed, the offsets contract is constantly monitored by an *offsets authority*. Most countries have an Offsets Management Office within their Ministry of Defence, while some country's offsets are managed by their Department of Trade and Industry or Commerce. A few such as the UAE, Kuwait and Spain have set up 'independent' Offsets Groups to handle offsets management. The role of an Offsets Department is crucial to ensure proper management, including the monitoring of the offsets implementation process. Therefore, issues such as organisational structure, staffing, processes and procedures, as well as implementation mechanisms must be considered by such organisations in order to maintain effectiveness and efficiency of the offsets programme. Sellers, for their part, will have to send in periodical reports to the offsets monitoring bodies on the progress of their projects. Offsets beneficiaries will also be required to constantly provide feedback to the government on progress, raising issues and challenges faced in the implementation phase.

The offsets process and implementation procedures are not straight forward. Different groups involved in the exercise make offsets practice complicated. Besides understanding the attributes of offsets, it is also vital to appreciate the offsets management process and how it operates within the procurement process of each buyer nation requiring offsets. The process is triggered by the announcement of defence procurement, normally undergoing several stages involving various stakeholders, such as the supplier company, buyer nation and its industry, and the Armed Forces in the case of a defence purchase. Given that the details of the process may vary from one country to another, the next section discusses the challenges faced in the offsets implementation process.

3.5 Challenges to Offsets Policy, Process and Implementation

The practice of offsets is bounded by complexities, arising from the lack of understanding on the usage and interpretation of offsets attributes as well as the differing approach to the offsets procedures, structure and implementation process. Further, the offsets policy and guidelines are fluid, constantly changing to accommodate the buyer country's political-economic objectives. It is therefore vital to address some of these complex challenges, analysing why they occur and how best to manage them. The various problems related to offsets are discussed below.

3.5.1 Non-Harmonisation of Offsets Practices

Various terminology and technical jargon are used in the practice of offsets. Each nation has a different interpretation of these terminologies, including the offsets criteria, selection process, threshold value, multipliers, penalty and monitoring processes. For instance, the application of multipliers can be confusing as buyers and sellers have different methods for evaluating and applying multipliers against projects. If buyer countries are not stringent with the awarding of multipliers, they may obtain too little of a programme for too much money. Multipliers cannot be fixed for all countries as each nation has its national development objectives to be achieved through offsets. Some countries, however, do have written fixed multipliers that can be used by sellers to draw up their offsets projects. These formulas are nevertheless detailed and complicated, often causing disputes between buyers and sellers.[59] Sellers try to achieve high multipliers in order to fulfil their offsets obligations. Due to the various complexities arising from the usage of multipliers, many offsets practicing countries either choose not to incorporate multipliers or to take a flexible approach of only applying them on a case-by-case basis.

3.5.2 Imposition of Penalties

Another challenge is related to the imposition of penalties for non-fulfilment of offsets obligations. Penalties may be a good option for pinning down defaulting contractors, but they may not be the best solution for completing offsets obligations successfully. Many nations resort to the usage of penalties for non-fulfilment of offsets obligations. Each nation has a different percentage of penalties and imposes different conditions for non-fulfilment. Defence contractors normally react negatively to this practice, claiming that penalties negate the spirit of partnership and goodwill in offsets dealings. Most contractors claim that they would normally try their best to fulfil offsets obligations, forecasting future business rather than forfeiting it.[60] Defence contractors also highlight the fact that penalties unnecessarily incur additional costs to buyers, as the bank guarantee for the amount specified will be factored into the overall equipment price. However, certain countries still continue to impose penalties quoting bad experiences of offsets obligors failing to fulfil their obligations. [61]

3.5.3 Codified versus Un-Codified Offsets Policy/Guideline

Besides the complexity arising from offsets attributes and processes, one of the most controversial issues is whether offsets policies and guidelines should be codified or otherwise. In recent years, most offsets practising countries have taken steps to formalise their policy/guidelines through publications/bills or Parliamentary Acts. Can a codified policy create greater clarity and transparency for both offsets providers and recipients?[62] From a seller's point of view, codified offsets policy allows a systematic and coordinated approach, whereby the offsets provider based on the codified policy will be able to plan, strategise and provide the best offsets deals suited to a recipient country's politico-economic needs and objectives. The need is to understand the internal offsets mechanisms of the recipient's offsets office and most importantly appreciate the greater transparency within the purchasing country's processes and procedures.

Buyers consider a codified offsets policy vital for ensuring continuity, especially if there is rapid movement of desk officers handling offsets within the offsets management office. A codified offsets policy can be reviewed from time to time to incorporate the recipient countries changing needs. Do offsets work better with or without a codified policy? The answer is again not straightforward. Countries like the UK, Sweden, Norway, the UAE, Kuwait, Oman, Greece, Poland and South Korea have codified offsets policies. Countries, such as Singapore, Japan, Malaysia and India do not have codified offsets policies but have had very successful offsets programmes in the past.[63] For these countries, a non-codified offsets policy provides greater flexibility and provision for continuous improvement on on going offset projects. Generally, a codified offsets policy may work better for countries where offsets desk officers lack in-depth knowledge of offsets with frequent changes of officers or attrition rates within the offsets set-up. Therefore, it is difficult to pinpoint whether offsets work better when they are codified, or otherwise, as the issue is again, country specific. However, recent trends clearly indicate that more and more countries are moving towards drawing-up codified offsets policy and guidelines.[64]

3.5.4 Issues of Causality and Additionality

A further contentious issue is that of causality and additionality. Causality and additionality play important roles in offsets implementation as most countries demand during the offsets negotiations that sellers prove that the offsets programme introduced into the buyer country has both these characteristics. In reality, can the impact of causality and additionality be measured? It is almost impossible to prove that the 'demand' was solely due to the offsets initiative and that it has created new business.

A famous example quoted by many authors with regard to additionality is the case where the UK government agreed in the 1990s to buy seven airborne warning and control (AWAC) aircraft from Boeing.[65] The deal committed Boeing to offering 130% offsets. Over 50% of the offset obligation was to be met by purchases of civilian aerospace products, including Rolls Royce engines to be used in civilian airliners. Since the civilian division of Boeing normally bought a substantial amount of aerospace products from UK suppliers anyway, there was considerable controversy as to whether the orders that Boeing wanted to count as an offsets obligation actually represented new business, or just a 'creative classification' that had nothing to do with the AWACs deal.[66] Another example is where the Malaysian government bought two Scorpene class submarines from DCN International (Armaris) (France) and Izar (Navantia) of Spain. One of the offsets deals was for the Spanish company (Izar) Navantia through a third party to award a contract to a Malaysian company, XY Base Sdn Bhd, for an IT project to upgrade the systems at the Barjeras airport. It was claimed that the contract would have been given to this company anyway due to its competitive pricing and work quality. In fact, reportedly, the project was already under discussion before the offsets programme was negotiated.[67]

The negative implications of offsets practices vary from one purchasing country to another. Buyer countries engaged in counterpurchase transactions may not be able to identify the additionality aspect or actualise new markets created by offsets providers. It may be impossible to discover whether the counterpurchase deal is new or just a diversion from one country to another. Often, commodity dealers complain that the counterpurchase arrangements distort the existing market, creating problems for commodity traders. [68] It is likely that offsets providers will view such arrangements as short-term and discontinue their purchase as soon as the obligations are over.[69] What happens to the supply of commodities to supplier countries or third party countries once the offsets deals are over? In Malaysia, for example, 50% of the countertrade deal for the purchase of the submarine from France and 50% for the Main Battle Tanks from Poland are to be offset by counterpurchase of commodities comprising palm oil, rubber, cocoa and other products. However, how does the offsets office at the Defence Industry Division, MOD, Malaysia, distinguish between a new sale and the continuoation of existing market relationship? As commodity trading is not the core business of defence suppliers, they will normally hire a commodity-trading company to undertake this work. The problem for the buyer country again is how to keep track and ensure that the trading house is not buying and selling to the existing market instead of new markets. For countries that do not have sufficient monitoring mechanisms, tracking such activities can be difficult, thus defeating the purpose of creating additional sales through counterpurchase deals.

3.5.5 Is Offsets Practice Transparent?

Offsets are also claimed to be non-transparent. They are said to be corrupt practices or a legal form of bribe.[70] Often, the complex and non-transparent way in which decisions are made to select and award offsets projects are questioned. Offsets are also said to inflate the price of the main defence equipment as most of the additional costs are factored into the offsets programme. The absence of a transparent process is also claimed to create loop-holes for corrupt practices in the offsets industry.[71]

There are initiatives to overcome the unnecessary complication and avoid the non-harmonised offsets practices amongst nations. The EU countries, for example, have sought to explore the possibility of harmonising offsets policy.[72] The European Defence Agency (EDA), an agency also responsible for offsets-related matters, has recently called upon the EU countries to harmonise offsets policy.[73] This initiative according to the EDA is to harmonise five practices: threshold value, selection, composition of direct-indirect offsets value, multipliers and terms. The harmonised policy will reflect the key features of the monitoring process. However, this initiative has received mixed signals from EU countries, as not all of them want to adopt a unified offsets policy due to then uneven level of defence industry development. [74] Similarly, in the US there are efforts to standardise offsets practice to eliminate corrupt and and inconsitent processes thereby enforcing maximum local production and employment creation within the US defence industries.

3.5.6 Increase in Price?

Do offsets costs money? There is arguably a certain amount of costs built into offsets. Offsets are certainly not a *free lunch* and someone has to pay for the tab. Who bears the costs of offsets? In this study's 2005 fieldwork involving twelve Malaysian offsets providers, all companies admitted that offsets cost money.[75] Such offsets costs are normally factored into the primary contract's equipment price. In most cases, the costs vary depending on the type of offsets programmes and the commercial viability of the offsets programme to the seller. For ventures that benefit suppliers, such as sub-contracting work involving minimal technology learning benefits, the offsets costs might be minimal. However, offsets involving human resource development, training and consultancy work will incur higher offsets costs. Similarly, for subcontractor production where the identified subcontractor does not have enough skills to produce quality products, the offsets costs will likely increase. The increased costs are then added to those of the primary contract, to be absorbed by the buyer country as an opportunity cost of maintaining domestic production.[76]

The setting-up of offsets operations within the seller's firm may incur additional operational costs, eventually increasing the costs of equipment. Offsets create an additional workload and thus costs for sellers. For example, many multinationals invest heavily into the offsets team, who need to be involved in extensive research to study economic development needs. Companies have to create extra positions and incur additional administrative costs to sustain offsets operations within their organisation. In the case of BAE Systems, which has a huge offsets set-up, it must absorb overall offset costs to maintain its offsets division. For some vendors, offsets can be a totally new experience and they will have to train staff. The issue becomes more complicated if the offsets requirements are not part of seller's core business, such as biotechnology, fisheries, agriculture and information technology. In such instances, the seller will have to hire independent third party advisors or agents to undertake the work. This again will incur additional costs to the sellers which are eventually likely to be transferred to the purchasing countries. Defence contractors would normally like to focus on their core business, finding indirect offsets obligations too demanding in terms of costs and financial resources.

A survey conducted in the UK suggests that offsets do cost more than off-the-shelf purchases, and, not surprisingly, vendors seek to include most of this premium in the selling price.[77] Wally Struys argues that Belgium has had to pay an estimated 20-30% in 'over-costs' in conjunction with offsets tied to military procurement.[78] Ann Markusen indicates that offsets cost between 7-10% of the value of arms sales,[79] whilst Finland estimates a 10-15% cost increase per offset agreement.[80]

A Dutch audit on offsets costs, prepared by Price Waterhouse Consulting (PWC) for the Netherlands' Ministry of Economic Affairs and Ministry of Defence, found that the costs of imposing offsets averages 2.9% of the value of the acquisition.[81] The findings also mention the factors influencing offset costs are the value and type (direct or indirect) of offsets obligation, the location of the foreign obligor and any possible cooperation with a foreign Ministry of Defence. Other factors, such as competitive tendering and the existence of a penalty clause, have no effect on offset costs. However, the Report qualified that this scenario only applies to Western European countries and may differ for other nations with different considerations.[82] A recent survey in Malaysia indicates that offshore vendors do build-in costs which may vary between 5-8%.[83] Although offsets are not free, it is difficult due to corporate sensitivity to obtain the exact amount of any offsets cost premium. There is no fixed percentage of offsets costs as this can vary depending on many external and internal factors relating to the offsets provider and recipient contractual arrangements.

Realising the multiple challenges faced in the practice of offsets, can offsets be successful? What are the factors that contribute to the successful practice of offsets? Several factors have been identified as contributing to the success of offsets. These factors are clustered into four areas and are discussed in the next section.

3.6 Offsets Success Factors: Key Discriminators

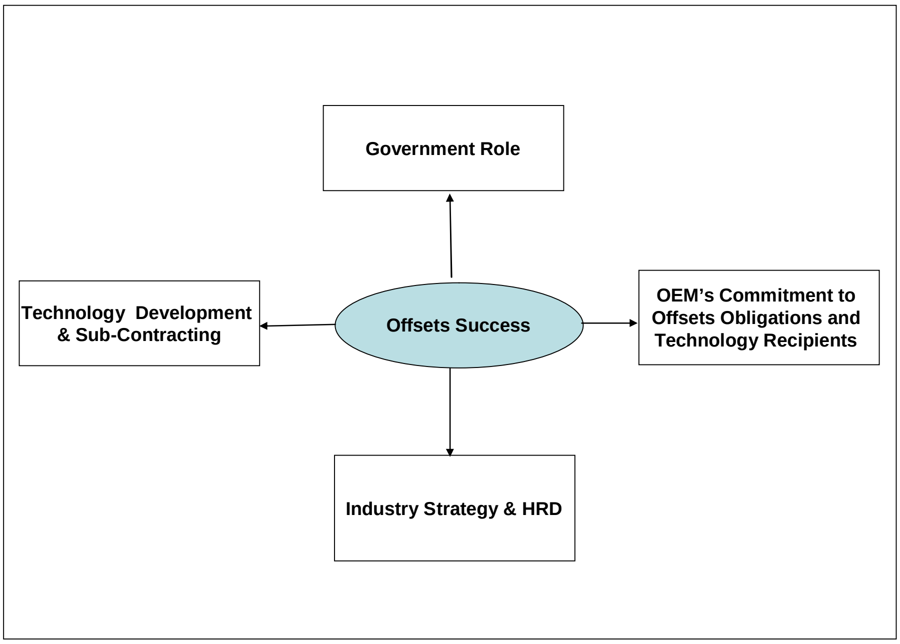
What determines offsets success? Various factors were identified as contributing to offsets success. Based on the literature review, four principal factors were identified as vital towards ensuring the success of offsets as a tool for industrial and technological development:

- Whether the buyer country has an offsets strategy, policy and implementation mechanisms in place to ensure positive offsets growth.
- The commitment of defence contractors and their governments towards ensuring the successful completion of the promised offsets programmes.

- The offsets recipient's capability and readiness to learn, absorb and effectively translate offsets programmes into successful projects as well as the ability to strengthen sub-contracting base.
- The offsets recipient companies' strategy and human resource development plans.

The interaction between these four elements, as shown in Figure 3.6 below, is fundamental to ensure a successful offsets programme.

Figure.3.6: Determinants of Offsets Success



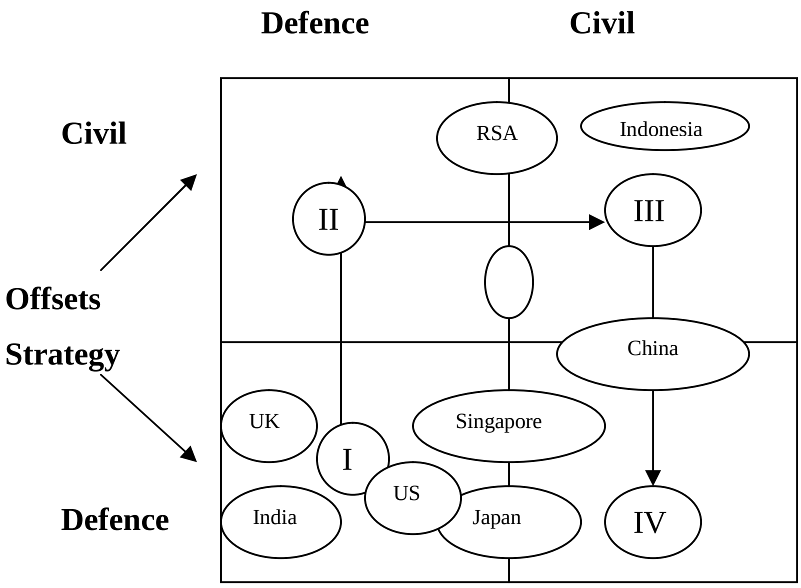
Source: Author

3.6.1 Recipient Government's Offsets Strategy, Policy and Implementation Process

In any examination of offsets success, the role of the purchasing country must be considered. Key factors include whether the purchasing country's government has in place clear offsets objectives and comprehensive strategies to meet those objectives and also whether offsets strategy and policy are in tandem with their national economic development plans, industrial policies and science and technology policies. National offsets objectives can vary according to geo-politics and the level of socio-economic development. Each country has its own rules on accepting offsets. Some countries limit offsets entirely to the defence industry and some direct their obligors to local companies they should work with.

Ron Matthews introduced an offsets matrix illustrating the mix of processes and objectives linked to the principal forms of offset strategy, as shown in Figure 3.7 below. Matthews' model has provided a neat demarcation of offsets strategy that has been practiced by various countries. The matrix is divided into four quadrants.

Figure 3.7: Matthews' Offsets Strategy Matrix



Source: Ron Matthews, Defence Offsets: Policy versus Pragmatism, *In:*Jurgen Bauer and Paul Dunne, Eds, Arms *Trade and Economic Development: Theory, Policy and Cases in Arms Trade Offsets*, Routledge, London and New York, 2004, p.93.

i. **Quadrant 1** shows a traditional offsets model, where a major weapon systems purchase from an offshore vendor is tied to a defence-related offset programme. Countries such as South Korea, the UK, India and the US are said to fall under Q1 where offsets are mainly tied to license agreements for in-country production of defence equipment or strengthening of the defence industrial base.

ii. **Quadrant II** talks about the high costs of defence R&D and how constrained production scales limit the economic benefits of defence offsets. The policy direction may shift from defence to civil offset requirement, and this is illustrated by countries like Saudi Arabia, Kuwait, Oman, and Malaysia falling into QII.

iii. **Quadrant III** illustrates civil-civil primary contracts for commercial items such as aerospace, power generation and telecommunications. Examples here include Indonesia's purchase of aircraft for Garuda airlines using leverage from purchasing airliners from Boeing and Airbus to obtain offsets fabrication work on the subassemblies of the aircraft purchased.

iv. **Quadrant IV** relates to dual-use industrialisation. Civil to defence offsets strategy emphasises the role of technology spin-on. Local defence industrialisation is underpinned by foreign technology transfer via licensed production of technologies in a recipient country's civil economy. Labour skills and manufacturing outputs, in turn, are transferred domestically from the civil to defence sector to foster development of sovereign defence industrial capacity. Japan is quoted as falling into this category.

These quadrants reflect the different offsets strategies pursued by each country towards achieving its offsets objectives.

India, for example, has been using offsets for decades through the defence equipment purchases to attain self-reliance based on political and economic factors. Politically, India's move towards self-reliance and indigenisation was based on its high-level security threat from its neighbours as well as being hurt by arms embargoes imposed by the US and the UK several times in the past. Economically, India wants to develop its own indigenous DIB and provide opportunities to its SMEs in terms of employment, training and technology transfer. Some nation's offsets objectives are focused on non-defence sectors such as agriculture, fisheries, petro-chemical and electronics. Countries in the Middle East have largely taken this approach. Defence Offsets has been a mechanism for reciprocal investment in the Gulf region since the mid-1980s. Offsets have been viewed as a ‘third wave’ to economic development, stimulating viable local manufacturing capabilities.[84]

For example, Kuwait, having established its offsets policy in 1992, has most of its offsets projects focused on manufacturing, with most of its regional inward investments geared towards ‘soft’ technology transfer through the provision of training packages, particularly the upgrading of local staff for equipment maintenance and servicing. Other projects include medical–human patient simulators, home health services, educational projects, eg.the IPETQ training institute as well as educational and scholarship funds. Also in the Middle-East, the UAE since 1995 has launched 21 joint ventures through various offsets programmes.[85] Projects include shipbuilding, aircraft and ship-leasing, central cooling systems, fish farming real estate, property management, commercial aviation maintenance, financial services, agriculture, green housing, medical waste management and medical insurance.

Finally, in the case of Saudi Arabia, there have been three major offsets projects:

i. US Peace Shield programme (worth 35% of the primary defence contract)
ii. Al Yamamah 1 and II.
iii. French Al Sawari (35% of the primary defence contract).

Al Yamamah and Al Sawari were heavily focused on the civil sectors. In the case of Al-Sawari, the French invested into the oil sectors, specialising in recycling of catalyst equipment, and a gold refinery, geared towards the processing of gold scrap. The Al Yamamah project’s objective was to develop commercially viable and profitable projects, facilitate investments and joint ventures by diversifying Saudi’s national income into non-petroleum activities. However, critics argue that contrary to the claims of economic diversification, most of the Saudi offsets projects have been concentrated in the petrochemical, oil and gas sectors, hardly advancing diversification.[86]

The buyer government needs to consider whether offsets are in line with the country’s national development objectives and whether offsets feature in all these documents.

Also, do offsets feature in purchasing countries short-and long-term procurement plans? Finally, has the purchasing government enforced local content input in defence procurement?

Other issues for consideration include competence in offsets negotiations, internal offsets processes, procedures, implementation mechanisms and auditing that could increase the efficiency and effectiveness of overall offsets performance. In developing countries, the extent of a purchasing government's selective intervention in assisting the success of offsets programmes should also be considered. Many countries have in place systems to closely monitor the progress of offsets projects. Periodic reports are to be submitted by OEMs to the offsets authorities. OEMs are also required to adhere to implementation schedules.

Certain countries have realistic and practical modes to calculate offsets output which can be used to measure offsets performance. In the case of the Czech Republic, for example, offsets are calculated based on the value generated by the investment or its export contracts for Czech companies and also technology transfers that generate Czech revenues.[87] Offset transaction values are confirmed annually, and are either the net export value generated in connection with new export contracts or net sales of goods or services based on that investment. Similarly, UK offsets performance is based on the commercial value or export value of the product produced through the industrial participation initiative. [88] Other crucial factors to be considered by developing countries include the ability of offsets authorities to plan, coordinate and negotiate offsets. Purchasing governments should have policies that can support the growth of supporting industries.

3.6.2 OEMs' Commitment to Offsets Obligations and Technology Recipients

With respect to the offshore vendor, several issues may be considered to ensure the success of the offsets programme. These include the sellers' willingness to transfer technology, the level and type of technology to be transferred, whether the technology is commercially viable, the cost of technology, intellectual property rights and patenting issues, the willingness to give away licenses, the ability to find suitable partners to collaborate on specific projects and the issues of cost-sharing. Also, there must be a commitment from vendors when offering the offsets package. Vendors should also undertake risk analysis of the purchasing country's political-economic conditions to be able to offer deals that are suitable to the recipient country's development requirements.

Sellers should ensure that the projects they propose are not 'one-off' deals. Defence contractors should be transparent in their dealings with local subcontractors, working towards not only ensuring successful completion of projects but helping prepare local partners secure sustainable business. Sellers need to be open for discussions on issues such as offset costs, project viability and the commercial potential of projects. The question is will the OEMs meet their offsets commitments once weapons and money have exchanged hands. Normally implementation of offsets may take a long time, often up to ten years. Thus, the political economic climate of the weapon supplying countries may change, impacting on relationships which may indirectly interfere with the completion of offsets deals as originally agreed. Defence suppliers should view offsets as long term partnerships and be willing to work with local firms without looking at short-term economic returns.

An interesting example of a supplier's commitment has regard to the 2004 BAE-SAAB Gripen programme in the Czech Republic. The offsets programme which runs from June 2004 to December 2014, is worth 25.5 billion CZK which represents 130% of the value of the lease payments for Grippen aircraft.[89] At December 2004, the project had officially accumulated an offsets value exceeding 4.2 billion CZK, which represents 16.5% of the total offset obligation.[90] BAES and SAAB have been jointly committed to attracting offsets projects, mainly indirect work, related to autocomponent manufacturing, electric tools, export-based investments, such as the production of power generation equipment, the supply of medical components, the export of spark plugs, nitro-cellulose and investment into producing a brake disc foundry and forging equipment for Saudi Arabia. These initiatives have largely benefitted the Czech manufacturing industry.[91] In the Gulf States, however, contractors claim that they are unable to deliver offsets projects effectively due to complicated and underdeveloped commercial laws, government bureaucracy, underdeveloped investment infrastructure, as well as cultural issues.[92]

3.6.3 Local Industrial Strategy and Human Resource Development

Another vital factor for offsets success is the recipient company's strategy in terms of employment, training, skills development and positioning in the global market. The issues to be considered include whether the local companies selected to participate in the offsets programme are willing to invest in infrastructure, human resource development, training and research and development. These companies should have a development strategy to enhance their competitive-edge in order to penetrate the global market. There should also have export and marketing strategies in-house. The most crucial factor is for the local suppliers to be able to participate in the offsets programme, and be able to compete internationally on the basis of price, quality and product characteristics. The recipient company should be prepared to invest into training towards human resource development to ensure that adequate workers with the sufficient level of capabilities are available to absorb the technology being transferred into the company. These workers should be prepared to undertake work in the relevant areas and maintain their competitiveness.

3.6.4 Technology Development and the Strengthening of the Subcontractor Base

A further success factor has regard to the offsets recipients' capacity to absorb technology, strengthening the subcontracting base within the country. The issue is whether offsets beneficiaries have the resources, i.e-capital, manpower, skills and raw materials, required to absorb the transferred technology and undertake work. Issues in this respect include the learning curve to be able to perform fully on identified projects and whether the offsets work is being awarded to beneficiaries with the right capability and resources. To ensure success, the offsets providers require the opportunity to audit the beneficiaries before the allocation of offsets. This practice may reduce programme failure as sometimes offsets projects are awarded to beneficiaries without the right capabilities or resources.

Supporting industries, mainly in the aerospace sectors, are vital to ensure high specialisation. This, for instance includes work such as painting, drilling, welding and wiring. Purchasing countries need to know whether they have a sufficiently strong base of supporting industries to assist the main contractors in offsets work. Main contractors should provide opportunities for supplier industries to grow. In the case of South Korean offsets, for example, the uneven growth of the country's DIB was linked to the monopoly dominance of a small number of large conglomerates –the *chaebol,* providing little diffusion of production work to small and medium-sized industries. At the end of 1995, 82 Korean defence contractors produced 308 types of defence equipment but the top ten *chaebol* accounted for 75% of production.[93] It is argued that the chaebol's dominance of the Korean industry minimised the multiplier effect from technology transfers and necessitated continued dependence on foreign firms through the procurement of spares and maintenance.[94]

Based on the above critical success factors, have offsets really worked? The next section examines whether offsets have contributed towards defence industrialisation in countries that have heavily engaged in offsets mainly for purposes of developing their defence industrial base.

3.7 Offsets as a Tool for Defence Industrial Development: Myth or Reality?

Offsets are viewed as a tool for achieving a self-reliant and resilient defence industry. Offsets are claimed to have had various impacts on the development of a nation's defence industry. These include technology development, employment, skills-enhancement, supply-chain development, and subcontractorisation and marketing. As discussed earlier, nations around the world view offsets as a tool to acquire capabilities to build their defence industries. Past examples have indicated that some nations have used offsets to develop capabilities to design, develop, manufacture, integrate and maintain the equipment. This can only be done if nations have the capital, human resources and sufficient material to undertake production in-country. This also depends on other factors such as a sufficient market for products competitiveness in terms of price, products and quality, as well as adequate infrastructural support, such as transportation, a safe political environment and attractive economic incentives.

However, the question is whether all countries should follow a similar path by utilising offsets credits to build their indigenous defence industry since the benefits of defence industrialisation especially for Third World countries, are often intangible. Ron Matthews, for example, argued that:

For third world nations, it can be argued that military-led industrialisation has contributed less to employment, due to its capital intensity, than many other industrial sectors, has encouraged the growth of research, design and development in a direction incompatible with the needs of society in the third world, has drained the civil economy of skilled labour, and has inflated the import-bill, at least in the short to medium term. Furthermore, in terms of export earnings potential, it is unclear how many Brazils the international market for arms could support over the longer term.[95]

3.7.1 Technology Development

In relation to technological development of indigenous defence industry, offsets may not have resulted in producing the best possible outcomes. Numerous offsets activities have resulted in technology transfer. For instance, in the Spanish CF-18 deal, offsets helped CASA develop its skills in the manufacturing of composite structural components for aircraft. The electronics firm, CESELSA (now under INDRA) established an important presence in the field of simulators and automated test beds[96] Also, India, has increased the technological capability of its defence industries, such as Hindustan Aeronautics Ltd (HAL), Bharat Electronic (BEL) and Mazagon Docks Ltd.[97]

However, in most cases the outcome of technology development through offsets has been minimal. Most technologies transferred are basic and often on the declining end of the supplier's product life cycle. Suppliers are said to be not willing to transfer 'know-how' for various reasons including their country's technology export control restrictions. In the case of Canada, for example, in the CF18 deal, it was claimed that the technology transfer programmes were mainly focused on build-to-print short term work which translated into little technology transfer on long-term benefits.[98] In the Spanish case, again, it was claimed that technology transfers through offsets were extremely concentrated, with minimal diffusion of defence technology.

First world defence suppliers invest huge amounts in R&D to invent and innovate the latest state-of-the-art technology; they then want a return from such investments. These technologies are transferred through licensed production or co-production, and buyer countries are charged a royalty for the technology. The Korean defence sector, comprising three big Korean companies and 20 smaller sub-contractors, have not been able to leap-frog stages of development enabling them to compete directly with major western producers.[99] Offsets have only helped South Korea build a modest domestic defence industry.[100]

In the Spanish case, the 84 F-18S fighters purchased from the US Mc Donnell Douglas Corporation (MDS) had an offsets value of US$1.8 billion, (later proportionally reduced to US$1.54 as the aircraft numbers were reduced to 72) but defence offsets only amounted to 28% and the final configuration was biased towards indirect offsets. This relatively low percentage was explained by Molas-Galart as due to limited capacity of the Spanish military-related industry to absorb a high volume of direct offsets.[101] When India bought MIG-21 aircraft from the Soviet Union in the 1960s under an offsets deal, the Soviets imposed restrictions on licensed production prohibiting India from exporting certain products to other countries. The Soviet Union was reluctant to provide complete technical information, withheld core technology and refused buy-back arrangements to India.[102] Another important example of technology development through offsets in the defence sector is South Africa, which has built production capabilities in landing gear fuselage sections for Gripen jet fighters and rudders and ailerons for other BAE Systems aeroplanes.[103]

In the past, developing countries have had a bad track record in terms of protecting intellectual property rights and patenting. Taiwan and South Korea, for example, have had IPR problems. Many multinationals have complained that their technologies have been pirated by small and medium scale industries in these countries, especially in the electrical and electronic sectors. Some of these problems have hindered the smooth transfer of technology from seller to buyer countries. Nevertheless, purchasing countries continue to demand technology through offsets. The learning curve in defence production can be steep, proving impossible for some countries, especially developing ones, to climb the technological ladder. Offsets can provide the opportunity to ‘catch-up’ in a market place that would otherwise be impossible.

The success of technology transfer depends on the physical, social, economic and technological environment in which the technology must operate. Developed country technologies require reasonably high quality utilities such as clean water, reliable electronic power supply, waste treatment facilities, interaction with other technology, high skilled maintenance personnel-equipped with state of the art tools to keep high technology equipment in good operating order.[104] Despite the higher costs and risks of failure, countries still engage in spin-off activities as they find it vital to invest in such technologies for national pride and self-sufficiency.

On the other hand, sellers are cautious of technology transferred though offsets as beneficiaries can in the long run acquire the capability to become possible competitors. This may create over-capacity in a particular niche area. Japan indigenised technology obtained through the US and was eventually able to demonstrate its technological prowess and compete with the US in the international commercial market. Seller country governments often view transfer of technology through offsets as creating possibilities for leakage of leading-edge weapons products and processes, undermining national and world security. There is increasing concern about the diversion of technology to unauthorised users and the need to prohibit third parties from obtaining sensitive military technologies and know-how. For example, Israel has reportedly transferred US-licensed missile and radar technology to China in the 1980s and 1990s, and has been charged with illegally incorporating US technology into weapons exported to South Africa, Chile, Ethiopia, and other countries that the US refuses to sell arms for human rights or foreign policy reasons.[105] Brazil transferred to Iraq technology obtained from a US offsets deal to improve Iraqi scud missile targeting capabilities. [106]

3.7.2 Employment

Despite the view that offsets increase the level of employment within the defence sector, evidence suggests that offsets have not brought in the promised amount of work. In a major South African arms acquisition deal valued at $3.9 billion dollars, the sellers promised to generate employment totalling 67,000 but eventually only a negligible amount of work was generated.[107] Saudi Arabia's multiple offsets programmes were said to have only created a few hundred local jobs, mostly unskilled.[108] The Spanish 1980's licensed production of the US F/A-18 aircraft was claimed to have generated substantial amount of work to the local industries but only at a considerable cost to the Spanish public funds used to subsidise the Spanish firms.[109] In the 1980s, there was a dispute between the UK MOD and the Defence Committee over work placed by Boeing under the AWACs project. A study on the AWACs offsets Agreement by the UK Parliamentary Defence Committee, states that 38% of the respondents claimed that were no impact on employment creation.[110] The net number of jobs sustained was 1279 and the net number of jobs created was only 1392.[111] In the Canadian F18 purchase, the 1984 auditor general's Report and the 1985 Nielson Task Force Report both argued that of the C$ 2.45 billion offsets package, 57% consisted of work that could have been done in Canada regardless of the contract and no subcontractor work was created by the offsets contract. Britain's Westland Helicopters (now Agusta Westland) claims that the Apache programme has created up to 3,000 British jobs, but in the longer-term, the net impact of offsets in the UK as a whole may lead to a loss of jobs. [112]

Offsets may be damaging for the seller country's economy as offsets transfer jobs out of seller's country. The US claims to have lost many jobs due to offsets. The National Defence Industrial Association (NDIA) has clamoured for the elimination of offsets to save the American industry.[113] The Federation of American Scientists (FAS) also lobbies hard on the subject of offsets, claiming that offsets have caused a threat to US jobs. A sample survey of 64 transactions by eight of the largest US aerospace companies over 1993-1998 found that direct offsets completed during this period supplanted $2.3 billion of US work or 25,000 work-years equivalent to 4,200 full-time jobs per year.[114] The US Bureau of Industry Offsets Report by the Department of Trade also projects a massive loss of jobs within the small and medium scale industries in the US due to US offsets obligations overseas.[115]

In the UK, the DTI claims that a substantial number of SMEs have in the past few years lost jobs to other countries where UK defence contractors have offsets obligations. The

European Defence Industries Group (EDIG) has voiced similar concerns on employment loss and has published a policy paper on offsets that outlines accrued benefits by redirecting revenue back to the domestic economy, maintaining market potential of these industries and increasing employment skills.[116] What these Reports fail to highlight is that the sale of the main equipment may actually sustain many more high-end research and development and high technology jobs within the seller's country, with only the low-end labour intensive jobs transferred through offsets related work.

3.7.3 Skills Enhancement

Offsets are claimed to enhance the skills of local workers, if they are able to learn, adapt and enhance technology for local production. Nevertheless, offsets are said to contribute towards raising the buyer countries' worker skills only if the standards of low-skilled labour are raised through offsets programme. Otherwise offsets are merely diverting skilled labour from one sector to another in the purchasing country.

Military oriented activities have little real economic value if the skills acquired through military-oriented production are not easily and cost effectively transferable to the commercial sector. Some skills may be transferable only after considerable reshaping of a potentially expensive process. Even for the kinds of skills that can be relatively easily transferred, there is the question of whether a military–oriented environment is the most cost-effective way of acquiring those skills.[117] Further, questions are raised as to whether the level of skilled workers employed through offsets training is simply from an existing pool of limited skilled workers available within the host country.

3.7.4 The Supply-Chain

Offsets are utilised by major defence suppliers to source efficient and effective subcontractors located overseas. Sellers are then able to improve their comparative advantage by moving parts of the production process to more cost effective locations abroad, where labour and raw material costs are significantly lower thus reducing equipment production costs. There is evidence that countries have benefitted from vertical disintegration, work-sharing arrangements, and subcontracting activities through offsets. [118]

An example of work specialisation through subcontracting is the F16 co-production arrangement with General Dynamics, in which a Dutch firm, DAF, became a subcontractor for landing gear equipment, supplying not only General Dynamics but all other manufacturers.[119] A similar case is that of Westland Helicopters which transferred technology to KIA, South Korea, to manufacture landing gears for Westland helicopters.[120] Today, KIA is not only able to produce landing gears for all Westland helicopters but has also captured the Korean civil market through the manufacture of landing gears for commercial aircraft, thus becoming a specialist in the manufacture of landing gears. [121] In the UK, for example, the willingness of US firms to transfer contracts, through offsets has led to work for small UK defence companies, such as Avimo (UK) Ltd and its work on the Apache AH-64-D project, and Hyde Engineering (UK) and its work on the C 130-J. This has resulted in the transfer of supply chain activity from the US to the UK.[122]

Offsets may benefit only the bigger and more powerful defence companies in certain countries. In Spain, for example, it is reported that 10 firms received the largest share of offsets activities.[123] Two of them, CASA (aerospace) and INDRA (electronics) account for 30% of all offsets obligations within the country.[124] This concentration exists despite the large number of firms that have participated in one or more offsets agreements.[125] The uneven growth in the ROK's defence industrial base was linked to the monopoly of the industry by a small number of large conglomerates, the *chaebol*, which facilitated little diffusion of production to small and medium–sized industry. South Africa also has similar problems in strengthening its backward linkages.[126]

3.7.5 Competition within Supplier Countries

The growth of offsets and the increasing outsourcing activities by large offshore prime contractors endangers the local small and medium sized defence contractors in the advanced countries. Offsets agreements that include subcontracting or licensed activities can displace local sub-suppliers, transferring jobs from these companies to low cost centres abroad. Offsets activities may enhance future competition from foreign competitors.[127]

To counter these negative effects, governments of large prime contractors implement measures to counter threats. The US government, for example, pays special attention to lower-tier subcontractors and the effects of offsets agreements. As a result, various bills such as the Buy America Act[128], Defence Production Act 1950, Arms Export Control Act 1968, National Authorization Act 1989, The Presidential Policy 1990 and the Feingold Amendment 1954 were all aimed at protecting the American defence industrial base.

In the UK, the risk of neglecting the home-grown defence industry might in the long run erode manufacturing capabilities. This has obliged the government to develop the Industrial Participation Policy. IPP aims to compensate UK businesses by providing work packages. The ‘participatory’ element of IPP takes the form of compensatory investment into the UK DIB by overseas vendors. The UK government is not seeking to protect its domestic defence industry, *per se*, but to enable local defence companies to bid under open competition for overseas defence contracts. It is envisaged that the winning of such contracts will stimulate higher-order, defence-related development and production activities in the UK.[129]

3.7.6 Sustainability

Offsets receiving countries may negotiate projects obligating exporting countries to buy-back products produced with the transferred technology. In most cases, contracts do not compel the principal contractor to maintain ties with sub-contractors. An offsets deal with a buy-back arrangement can only work if the buyer country has the capacity and competitiveness to sustain the business momentum once the offsets programme ends. Otherwise the buy-back process will fail.[130] Short-term solutions have proven to be worthless, as once foreign suppliers have completed their offsets obligations, operations will cease to exist. In the UK, IP work is measured in terms of volume of work but there are no explicit mechanisms to ensure that this volume is converted into long-term growth potential.[131] In South Africa there was a debate about defence offsets being leveraged into sectors with the capacity to maintain sustainability of employment and 'basic needs' public-utility sectors, such as housing, transport, energy and communication.[132]

Indonesian defence industries, heavily subsidised by the government, could not sustain their activities during the Asian Financial Crisis. IPTN had to downsize due to outstanding debts of $570 million, eliminating 5,000 jobs, and holding back projects including the CN-235 and N-2130.[133] In the case of the Philippines, the 1992 GKN Sankey Limited (UK) 150 wheeled personnel vehicles (Samba) contract (Value: $56, 272) involved the assembly in-country of 142 vehicles.[134] Although there was limited technology transfer and employment created, the plant had to shut-down with worker retrenchment as there was no succession plan for exports or marketing in the contract.[135]

3.8 Summary

Offsets are complex, employing complicated terminologies and processes. Nevertheless, offsets remain a popular mode of trade transaction, especially amongst the defence industry community. The objective of this chapter has been to encapsulate the various issues revolving around offsets, evaluating whether offsets work. This chapter has discussed offsets definitional tools, processes and workings; the complex issues surrounding offsets practices and success factors. There is no straightforward answer to whether offsets can or cannot work. Offsets success is 'country-specific' and depends largely on each nation's offsets strategy, policy and processes. Based on general analysis in this chapter, the next two chapters analyses whether offsets work in Malaysia, with particular reference to the Malaysian defence industry. To begin, the next chapter will provide an in-depth analysis of Malaysia's defence industrial context and the role that offsets have played in the development of its defence industry base.

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[2] Article XVI of the General Agreement on Tariff and Trade(GATT)'s 1979 Government Procurement Code, now known as World Trade Organisation's (WTO)'s Agreement on Government Procurement accepts offsets for developing countries This exemption will certainly be maximised by many developing countries to continue pursuing offsets in their international procurements.

[3] Recent statistics indicate that offsets obligations around the world are steadily on the rise. For instance, the US Department of Commerce, Bureau of Trade and Industry Offsets (BIS) Report, since 1992 shows a constant increase in US offsets obligation overseas. Additionally, BIS, in its March 2005 Report on offsets indicated that US prime contractors alone have signed 466 new offsets agreements totalling USD 50.7 billion from 1993-2003 as compared to its total defence exports of USD$ 70.9 billion.

[4] Countertrade is defined as reciprocal and compensatory trade agreements as involving the purchase of good and services by the buyer from the seller, or arrangements whereby the seller assists the buyer in reducing the amount of the net cost of the purchase through some form of compensatory financing. See Grant T Hammond, *Countertrade, Offsets and Barter in International Political Economy,*(Pinter Publishers, London, 1990), p.7.

[5] Ibid, p.3.

[6] For further details see M Korth, Ed, *International Countertrade,* (Quorum Books, New York, 1987), p.2.

[7] Mr. Johan Van Dyk was employed by Denel Pty Ltd to conduct two offsets workshops for Malaysians involved in offsets work. The first workshop was conducted in 2000 and the second in 2001 in Kuala Lumpur. This was done under an offsets arrangement for the procurement of the G5-155mm artillery piece.

[8] See also S Rubin, *the Business Manager's Guide to Barter, Offset and Countertrade*, (Economic Intelligence Unit, London, 1986), p.15.

[9]See also R E Weigand, 'International Trade without Money', *Harvard Business Review*, November-December 1977, p. 30.

[10] Most defence companies do not have the experience or in-house expertise to handle counterpurchase. Counterpurchase transactions are outsourced to trading companies thus incurring additional administration and operating costs for defence companies.

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[20] *Additionality* refers to new projects that have been introduced that would not have occurred if not through offsets.

[21] *Causality* refers to establishing the relationship between offsets and the project establishing that offsets were the main cause for the project.

[22] United States. *Status Report of the Presidential Commission in International Trade*, (Washington, January 18, 2001).

[23] See Ron Matthews, 'Home Guard', *Financial Management*, Jun, 2003, 22; Aee also F.S, Petty, 'Defence Offsets: A Strategic Military Perspective', *The DISAM Journal*, 1999, 65-81;
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[29] See also Herbert Wulf, Arms Production in Third World Countries, Effects on Industrialisation, *In:* Christian Schmidt, Ed, *The Economics of Military Expenditures: Military Expenditures, Economic Growth, and Fluctuations,* (St Martin's Press, New York, 1987), pp. 357-383; Nicole Ball, *Security and Economy in the Third World*,(Princeton University Press , Princeton, NJ, 1988).

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[40] Ibid, p.337.

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[50] M Kostecki, 'Should One Countertrade*? Journal of World Trade Law,* April, 1987, 7-21.

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[59] Poland, Greece and the Nordic countries have tedious and complicated offsets multipliers and formulas. Sellers often find this approach to be too rigid and complex. Most of them are not are able to understand how the multipliers work. .

[60] Some contractors claim that if they wished, they could easily pay-off the penalty amount, which is negligible as compared to total equipment costs and release themselves from offsets obligations. However, many of them wish not to do so as they claim to seek long-term business partnerships with purchasing countries.

[61] As compared to developed countries and countries with repeated equipment orders that can afford to practice a 'best endeavour' policy, smaller developing countries with one-off purchases are often worried that defence suppliers may not honour their words knowing that there might not be future business.

[62] From a questionnaire distributed to 18 offshore vendors in Malaysia, 11 of them agreed that they would prefer a codified offsets policy.

[63] Malaysia and India, have, however, recently introduced codified offsets policies.

[64] Grant Rogan of Summit Corporate Services, who has been involved in drawing up offsets policies for Gulf States, claims that there is a growing interest from many countries, especially developing countries, requesting codified offsets policy. Currently, he is advising several countries on drawing up their offsets policy. Mr. Adrian Dalton of DESO,UK also claims that he has been approached by countries like India, Malaysia, and a few others to advice them on their offsets policy. Interview with Mr. Adrian Dalton, July, 2005

[65] Stephen Martin and Keith Hartley, The UK Experience with Offsets, *In:* S Martin, Ed, the *Economics of Offsets: Defence Procurement and Countertrade,* (Harwood Publication, Amsterdam, 1996), pp.338-346.

[66] Ibid, pp.338-346.

[67] Interview with a Malaysian official at the Defence Industry Division, Ministry of Defence, Malaysia, 2005, 15 Jun.

[68] Feedback from an interview conducted with an official from the Ministry of Primary Industries, Malaysia, 2006, 16 June.

[69] In the case of palm oil dealings in Asia, Indonesia claimed to have lost a substantial amount of business created through offsets which was then transferred through offsets arrangements to a neighbouring country, Malaysia. Malaysia obtained huge amounts of counter-purchase deals from 2001 to 2003 through its defence equipment purchases mainly from France, Poland and Russia.

[70] Interview with a senior civil servant of the Ministry of Defence, Malaysia. The subject requested that his name not be disclosed, June 2005.

[71] Ibid.

[72] The issue of harmonising offsets amongst nations especially among EU member nations was debated at two forums represented by government offsets authorities. The first forum entitled 'IP Policies and Guidelines' Hague, Netherlands' October 2004 and the second forum entitled International Seminar on Industrial Cooperation and Offset in the Defence Market' Madrid, Spain, March, 2006.

[73] EDA was formed in July 2004. The agency's aim is to support the Council and the Member States in their effort to improve European defence capabilities in the field of crisis management and to sustain the ESDP as it stands now and will evolve in the future. EDA's main function includes developing defence capabilities, promoting armaments co-operation, promoting collaborative defence research, improving the European defence industrial and technological base (EDTIB) and supporting the creation of a competitive European defence market (EDEM). Sandra Mezzadi, 'European Defence Agency: Harmonisation of Offsets at EU Level', *In: 06 International Seminar on Industrial Cooperation and Offset in the Defence Market,* 12 April 2006, (Isdefe Gerencia de Cooperación Industrial, (ISDEFE), Madrid, Spain, 2006).

[74] Enrique Navarro, The Future of Industrial Cooperation Policy and Offsets in Defence Market: Challenges and Risks, *In*: *06 International Seminar Industrial Cooperation and Offset in the Defence Market,* April 2006, (Isdefe Gerencia de Cooperación Industrial, (ISDEFE), Madrid, Spain, 2006),

[75] Interview results obtained during fieldwork survey in Malaysia from 12 OEMs supplying defence equipments to Malaysia, May-July 2005.

[76] Some examples of offsets administrative costs include in-house and/or purchased organisational, administrative and technical support, including offset staffing, quality assurance, manufacturing,

purchasing support, data acquisition; proposal, transaction and report preparation: broker/trading services; legal support; and similar support activities; off-shore operations for technical representatives and consultant activities, office operations, customer and industry interface, capability surveys; marketing assistance and related technical assistance, transfer of technical information and related training; employee travel and subsistence costs; and taxes and duties.

[77] S Martin, Introduction and Overview, *In* S Martin, Ed, t*he Economics of Offsets: Defence Procurement and Countertrade*, (Harwood Publication, Amsterdam, 1996), pp. 7-8.

[78] Wally, Struys, Offsets in Belgium: Between Scylla and Charybdis? *In:* J Brauer, and J P. Dunne, Eds, *Arms Trade and Economic Development Theory, Policy and Cases in Arms Trade Offsets*, (Routledge, London, 2004), pp.164-171

[79] Ann Markusen, Arms Trade as Illiberal Trade, *In:* J Brauer, and J P Dunne, *Arms Trade and Economic Development Theory, Policy and Cases in Arms Trade Offsets,* (Routledge, London, 2004), p.71.

[80] *JAS Industrisamverkan,* 'Report' DsI 1968:8 Stockholm: MO Industry, 1986.

[81] 'Dutch Audit-A Remarkable Document That Shows Offset Provides Substantial Measurable Benefits', *Countertrade and Offsets*, XXI (10), 2003, pp.2-4.

[82] The report qualified that for countries like Malaysia, Kuwait and Turkey, there are other considerations in factoring offsets costs. Ibid, pp. 2-4.

[83] Interview results obtained during fieldwork survey in Malaysia from 12 OEMs supplying defence equipments to Malaysia, May-July 2005.

[84] Ron Matthews, 'Saudi Arabia's Defence Offsets Programmes: Progress, Policy and Performance', *Defence and Peace Economics*, 7, 2001, 223.

[85] Grant Rogan, Offsets in the Gulf, *In: 04 Global Industrial Co-Operation Conference, Penha Longa, 28-31 March, 2004* (GOCA, Portugal, 2004), p.10.

[86] Op cit, p.223.

[87] Information obtained through fieldwork research carried out at the BAE Office in Prague, March 2006. Exclusive interview with Mr. Paul Mead, BAES, Prague Office, March, 2006.

[88] Interview with Mr. Adrian Dalton, IP Project Manager, Defence Export Services Organisation (DESO), June 2005.

[89] Gripen. Company Directory, [online], (Gripen, United Kingdom, 2006), Accessed 25 May 2006), Available at: http: www.gripen.com; Further information was also obtained from BAE Office, Prague, March 2006.

[90] Ibid.

[91] Ibid.

[92] Grant Rogan, 'Offsets in the Gulf', *In: 2004 Global Industrial Co-Operation Conference, Pehna Longa, Sintra, 28-31 March, 2004,* (GOCA, Portugal, 2004), p.10.

[93] *'Jane's Sentinel Security Assessment-China and Northeast Asia-09: Defence Production and R&D'*, September 18, 2002,

[94] Ibid, p.7.

[95] Ron Matthews, *Defence Production in India*, (ABC Publishing House, New Delhi), 1989, p.8.

[96] Jordi Molas-Gallart, From Offsets to Industrial Corporation: Spain's Changing Strategies as an Arms Importer, *In:* S Martin, Ed, *the Economic Of offsets: Defence Procurement and Countertrade*, (Harwood Publication, Amsterdam, 1996), p.306.

[97] See A K Gosh, *India's Defence Budget and Expenditure in the Wider Context*, (Lancer Publication, New Delhi, 1996).

[98] James Fergusson, In Search of a Strategy: The Evolution of Canadian Defence Industrial and Regional Benefits Policy, *In:* S Martin, Ed, *The Economics of Offsets: Defence Procurement and Countertrade*, (Harwood Publication, Amsterdam, 1996), pp.107-115

[99] Dean Cheng and Michael W Chinworth, The Teeth of the Little Tigers: Offsets, Defence Production and Economic Development in South Korea and Taiwan, *In*: S Martin, Ed, t*he Economic Of offsets: Defence Procurement and Countertrade*, (Harwood Publication, Amsterdam, 1996), pp.245-279.

[100] Ibid, pp.245-279.

[101] Jordi Molas-Gallart, From Offsets to Industrial Corporation: Spain's Changing Strategies as an Arms Importer, *In*: S Martin Ed, *The Economic of Offsets: Defence Procurement and Countertrade*, (Harwood Publication, Amsterdam, 1996), pp.302-304.

[102] S Mehrotra, *India and the Soviet Union: Trade and Technology Transfer*, (Cambridge University Press, Cambridge, 1990), p.135.

[103] J Paul Dunne and Guy Lamb, Defence Industrial Participation: The South African Experience, *In:* J Brauer and J P Dunne, *Arms Trade and Economic Development Theory, Policy and Cases in Arms Trade Offsets*, (Routledge, London, 2004), pp.284-298.

[104] See L J Dumas, Finding the Future: The Role of Conversion in Shaping the Twenty-First Century, *In:* L J Dumas, Ed, *The Socio Economics of Conversion from War to Peace*, M E Sharpe, (Armonk NY& London, 1995); P M MacCorqudale, J Gillilant, Kash and A Jameton, Eds, Engineering and Economic Conversion, (Springer-Vertag, New York, 1993).

[105] Lumpe, 'Sweet Deals, Stolen Jobs' *The Bulletin of the Atomic Scientists*, September-October, 1994, 35.

[106] C Evans, Offsets: Drivers and Technological and Policy Consequences, *In*: C Wessner & A Wolff, Eds., *Policy Issues in Aerospace Offsets*, (National Academy Press, Washington D.C, 1997), pp.14-15

[107] ARMSCOR, 'Defence Industrial Participation (DIP)', *Armaments Corporation of South Africa* (ARMSCOR), URL:http:// www.armscor.co.za/DIS/What1sDIP.asp., 2004.

[108] Ron Matthews, 'Saudi Arabia's Defence Offsets Programme: Progress, Policy and Performance', *Defence and Peace Economics*, 5(4), 1996, 315-338.

[109] Jordi Molas Gallart, From Offsets to Industrial Cooperation: Spain's Changing Strategies as an Arms Importer, *In*: S Martin, Ed, *The Economics of Defence Offsets, Defence Procurement and Countertra*de, (Harwood Academic Publishers, Amsterdam, 1996),pp.299-320.

[110] Stephen Martin and Keith Hartley, The UK Experience with Offsets, *In:* S. Martin, Ed, *the Economics of Defence Offsets, Defence Procurement and Countertrade*, (Harwood Academic Publishers, Amsterdam, 1996), p.337.

[111] Ibid, p.341.

[112] Spears, *1997 Presentation on the Role of Offsets in the International Arms Trade, (*International Studies Association, Annual Meeting, Toronto, 19 March 1997).

[113] US Presidential Commission, *The 2004 National Defence Industrial Association,* [online], (Accessed: Januray 2005), Avialable at : http:/www.ndia.org;
See also United Status. Government Accounting Office, *Status Report of the Presidential Commission on Offsets in International Trade,* (Office of Management and Budget, Washington D.C, 18 January 2001), pp i-iv.

[114] Ibid, pp i-iv.

[115] US Department of Commerce, *Offsets in Defence Trade: Ninth Study,* [online], (Bereau of Industry and Security, US, 2005), (Accessed: March 2007), Available at:
http// www.bis.doc.gov/defenceindustrialbaseprograms.

[116] Belgium, EDIG paper on Offsets, *05 European Defence Industries Group' 11 March 2005,* (EDIG, Brussels, 2005), pp.26-6; also see E.Dirksen, 'The Defence Industry Interface: the Dutch Approach', *Defence and Peace Economics,* 9 (1and 2), 1998, pp.83-97.

[117] L J Dumas, Finding the Future: The Role of Conversion in Shaping the Twenty-First Century, *In:* L J Dumas, Ed, *The Socio Economic Conversion from War to Peace,* (M E Sharpe, Armonk NY, London, 1995); MacCorqudale, P M Gilliland, J Kash and A Jameton, Eds., *Engineers and Economic Conversion,* (Springer-Verlag, New York, 1993).

[118] Ron Matthews, Defence Offsets: Policy versus Pragmatism, *In*: J Brauer, and J P Dunne, *Arms Trade and Economic Development Theory, Policy and Cases in Arms Trade Offsets,* (Routledge, London, 2004), p 96; Stefan Markowski and Peter Hall, Defence Offsets in Australia and New Zealand, *In:* J Brauer, and J P Dunne, *Arms Trade and Economic Development Theory, Policy and Cases in Arms Trade Offsets,* (Routledge, London, 2004), p. 274.

[119] Interview with Mr. Simon Edge, Offsets Manager, Westland Helicopters, Yeovil, England, 22 March 2005.

[120] G Hammond, *Countertrade, Offsets and Barter in International Political Economy,* (St. Martin's Press, New York, 1990), pp.10-12.

[121] Interview conducted with offsets development programme manager in South Korea, Simon Edge at Westland Helicopters manufacturing plant in Yeovil, Somerset, 18 March, 2005.

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[122] R J E Williams, *The UK's Industrial Participation Policy-Strengths and Weaknesses,* MDA Dissertation, No.12, (Cranfield University, UK Defence Academy, Shrivenham, July 1998), pp.74-79.

[123] Jordi Molas Gallart, From Offsets to Industrial Cooperation: Spain's Changing Strategies as an Arms Importer, *In:* S Martin, Ed, *The Economics of Defence Offsets, Defence Procurement and Countertra*de, (Harwood Academic Publishers, Amsterdam, 1996), pp.299-320.

[124] Ibid, pp. 306-307.

[125] Ibid, p. 306.

[126] See W Shiaiya, The Future of Offsets in Small Countries: the Belgian Case, *In: 01 Fifth Annual Conference on Economic and Security, Middlesex, June 2001*, (University of London, 2001).

[127] R Hawkins, Detriments in Offsets Policy: A US Viewpoint on Offsets, *In: 06 Conference on International Defence Offsets, Hatton, 22&23 March,2006* (SMI Conference, London, 2006), p.7.

[128] 'Buy National Preferences' in the United States affect government purchases only and operates much like a tariff. This preference traces back to the Buy American Act of 1933. The defence department has adopted a policy under the Act of giving a 50% margin to domestic producers while other government agencies offer a six percent preference to American suppliers. The Buy America Act requires that at least half of the components in products that DHS purchases be mined, produced, or manufactured within the country. The requirement could only be waived with the permission of the congress.

[129]Ron Matthews and Richard Williams, 'Technology Transfer: Examining Britain's Defence Industrial Participation Policy: Defence and International Security, *RUSI Journal*, April, 2000, p.26.

[130] See also L J Dumas, The Conversion of Military Economy, *In:* L J Dumas, Ed., *the Political Economy of Arms Reduction: Reversing Economic Decay*: (American Association for the Advancement of Science and Westview Press, Boulder, CD, 1982).

[131] R J E Williams, *The UK's Industrial Participation Policy-Strengths and Weaknesses*, MDA Dissertation, No.12, (Cranfield University, UK Defence Academy, Shrivenham, July 1998), p.91; In the case of the Swiss offsets practice, it was also concluded that offsets were not able to sustain the defence industrial base. For further details, see S Rapaz, *Swiss Defence Offsets: the Case of Aerospace,* MDA Dissertation, No.18, (Cranfield University, UK Defence Academy, 2004).

[132] Paul Dunne and Guy Lamb, Defence Industrial Participation: The South African Experience, *In*: J Brauer, and J P Dunne, *Arms Trade and Economic Development Theory, Policy and Cases in Arms Trade Offsets*, (Routledge, London, 2004), pp.284-298.

[133] M Cohen, 'New Flight Plan', *Far Eastern Economic Review*, 2 March 2000, p.45.

[134] Agaton J Y, Villalon, *Philippine Defence Industrial Development and Offsets*, MDA Dissertation, No.12, (Cranfield University, UK Defence Academy, July 1998), p.28.

[135] Ibid, p.28.

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Chapter 4

4. DEFENCE INDUSTRIALISATION IN MALAYSIA: DEVELOPMENT CHALLENGES AND THE ROLE OF OFFSETS

4.1 Developing Nations: The 'Need' for Defence Industrialisation

The first duty of the sovereign is that of protecting society from the violence and invasion of other independent societies, can be performed only by means of military force. But the expense both of preparing this military force in time of peace, and employing it in times of war, is very different in the different states of society, in the different periods of improvements.

Adam Smith
An Inquiry into the Nature and Causes of the Wealth of Nations (1776)

Contrary to Adam's Smith's quote on the socio-economic costs of maintaining military prowess, arms deals continue to feature as an important component in a nation's defence economy. The range and diversity of arms producing countries can be clustered into three different categories - first tier, second tier and third tier. First-tier arms producers are the US, the UK, France, Germany and Italy, collectively accounting for 75% of global arms production and dominating defence R&D.[1] Second tier arms producers would be those on the spectrum between the most and the least advanced countries. Countries such as Argentina, Brazil, Singapore, South Africa and South Korea fall into this category.[2] Third tier countries are defined as those possessing low-technology production capabilities. Developing countries fall into this category.

Developing countries pursue the long-term goal of establishing indigenous arms production even though they have not been able to eliminate or reduce dependence on imports. These countries are still dependent on foreign inputs in critical sectors, such as design, systems engineering, high-tech components and sub-systems. In fact, few of them have been able to successfully absorb technological know-how due to the stringent export controls imposed by foreign suppliers. [3]

In recent years, the technological gap between the developed and developing countries has further widened due to various factors including the lack of qualified human resources within host economies to absorb technology and also often the reluctance of OEMs to transfer critical technologies for fear of potential competitors eating into their market share.[4] Observers have also argued that indigenous production can be a costly affair for developing countries, with barriers to technology transfer from military to civilian applications, the secrecy with which the military handles most of its R&D projects and manufacturing processes, the importance paid to performance of equipment rather than cost, the complexity of programmes and the lack of economies of scale.[5] Why do small developing nations still then persist in pursuing defence industrialisation?

Developing nations with limited resources for socio-economic development spend large proportions of their budgets on defence, pursuing arms production for non-economic and economic reasons. Arms production is of recent origin to these countries.[6] In relation to the non-economic aspect, developing nations pursue arms production for strategic reasons including the need to overcome weapon embargoes.[7] Political motives include considerations of foreign policy and the leveraging of military production for regional power recognition.[8] Developing nations have recognised the benefits of building a defence industrial base that is capable of supporting self-reliant Armed Forces, further adding to their defence capability.

In an economic sense, a developing country's defence industrial structure doubles up to meet the country's scientific, technological and strategic needs. In line with the pursuance of defence industrialisation, the defence industry is viewed as a catalyst for capacity-building, creating high-value added products, promoting backward linkages to support industries, as well as dual-use technology, employment, export promotion, absorption of high-technology and spin-offs that boost the civilian economy.[9] Latecomers to defence industrialisation include Argentina, India, Turkey and South Africa, all of whom have pursued aggressive defence industrialisation strategies with the aim of achieving technological and industrial development. Small emerging economies, such as Malaysia, aspire to go down a similar route in the search for indigenous defence industrialisation.

Malaysia decided to undertake defence industrialisation for both economic and military reasons. Defence industry development was mainly aimed at self-reliance in spares and logistic support, modification, upgrades, retrofits, maintenance, repair and overhauls without foreign assistance.[10] Technically, a domestic defence industry is essential in the long-run to ensure the continuous supply of weapons, ammunitions and spares in times of crisis, thus saving cost and at the same time upgrading the performance of weapons procured. A defence industrial base is also needed to create high technology employment, value-added work, and also backward linkages in support of small and medium scale industries, especially heavy manufacturing industries and dual-use technology. Strategically, Malaysia also pursues defence industrialisation to obtain high-end sensitive military technology and know-how.

The State continues to play a vital role in nurturing Malaysia's defence industry through mechanisms such as defence procurement and offsets. The government invests a great deal of financial and human resources in the development of Malaysia's defence industry. The question, however, is whether after more then 30 years of investment, the defence industry has attained the capability and performance expected? Has there been sufficient attention and resources allocated to the growth of this sector? What have been the challenges faced by the industry during its development path? Has the defence industry been treated as a strategic industry for political reasons, rather than as a vehicle for industrial and technological development of the country? Finally, has Malaysia's defence industry policy focussed sufficiently on the development of strategic sectors, identified the challenges, and considered the strategies that can move the Malaysian defence industry forward?

The objective of this chapter is thus to discuss Malaysia's defence industrial push, its strategy, development, performance as well as the role of offsets in the sector's development. Section 4.1 provides a general definition of the defence industrial and technological stages in the defence industrialisation process, prior to focusing on the Malaysian industrial base. Section 4.2 provides a broad overview of Malaysia's defence industrial push. It discusses the development of Malaysia's defence industrialisation in the national industrial strategy and the influence of defence and procurement policy in defence industrialisation. Section 4.3 discusses Malaysia's defence industrial policy and how this policy fits into the nation's development strategies. Section 4.4 discusses the role of the state in Malaysian defence industrial development. The section explains the role of various governmental and non-governmental agencies in supporting Malaysia's defence industry. Section 4.5 explains the origins of the defence industry in Malaysia and the various stages involved in securing technological maturity. Section 4.6 critically analyses Malaysia's defence industry structure and its capabilities to undertake defence industry work. Section 4.7 examines Malaysia's defence industrial development based on six sectors - aerospace, weapons, automotive, maritime, ICT and common-users.[11] Section 4.8 analyses the development of Malaysia's subcontracting base through defence industrialisation, evaluating government initiatives and performance. Finally, Section 4.9 briefly introduces the subject of offsets as a catalyst towards the development of Malaysia's defence industrial development. The final section paves the way for detailed analysis in the next chapter on the effectiveness of offsets in the Malaysian defence context.

4.2 Defining Defence Industrialisation (DIB)

Defining a DIB is not a trivial exercise. The DIB is used interchangeably with arms production and military production. A DIB is defined by some observers as being confined to companies that provide defence and defence-related equipment and services to the Ministry of Defence and the Armed Forces.[12] Gavin Kennedy uses the word defence market [13] to identify defence industry.[14] He provides a narrow definition and a broader definition of the defence market: the narrow definition being current[15] and capital purchase[16] of goods and services, including manpower, by the defence agencies for national security; the broader definition being any services that contributed to national security. Other definitions take a broader approach, with the DIB embracing industrial sectors that manufacture military goods as well as civil goods.[17] Molas-Gallart distinguishes three different discriminating factors to define military production, namely, the client, product specificity, and the final use of the product.[18] The client base in the case of military production comprises the defence agencies and specifically the Armed Forces; the second indicator is product specificity, being outputs produced by the military industry, either pure military goods or non-specialised products; the third indicator reflects the final use of the product, i.e. those products used in combat for war fighting or immobilising enemy forces being classified as military production.[19] In general, most sources agree that the defence industry designation depends upon the nature of the industry's output, and that its end-use is for defence purposes. The absence of an industrial classification under ISIC solely dedicated to the defence industry makes the analysis of defence industry activities difficult.

The Malaysian DIB is defined as comprising activities that are related to defence production, encompassing production of capital equipment, components and spares as well as maintenance and repair services to meet the in-country military and security needs of the country.[20] Malaysia also classifies its DIB as a 'strategic industry' with the bulk of its production destined for defence markets, including the Malaysian Ministry of Defence. A strategic industry in this case is defined as an industry that provides key elements of military power and national security, demanding special consideration by government.[21] Based on the various definitions above, this study embraces the Malaysian definition of defence industrialisation.

In general terms, each nation goes through a series of arms production stages before qualifying as an independent platform manufacturer possessing fully-fledged research and development capabilities. Keith Krause[22] provides an elaborate explanation of defence industrialisation by identifying eleven stages of activities. This is shown in Table 4.1, constituting a DIB ranging from simple maintenance tasks on imported arms to the possession of an independent R&D production capability.

Table 4.1: Path Towards Indigenisation of Arms Production

Number	Activity
1	Capability of performing simple maintenance
2	Overhaul, refurbishment and rudimentary modification capabilities
3	Assembly of imported components and simple licensed production
4	Local production of components or raw materials
5	Final assembly of less sophisticated weapons; some local component production
6	Co-production or complete licensed production of less sophisticated weapons
7	Limited R&D improvements to local license-production of arms
8	Limited independent production of less sophisticated weapons; limited production of more advanced weapons
9	Independent R&D and production of less sophisticated weapons
10	Independent R&D and production of advanced arms with foreign components
11	Completely independent R&D and production

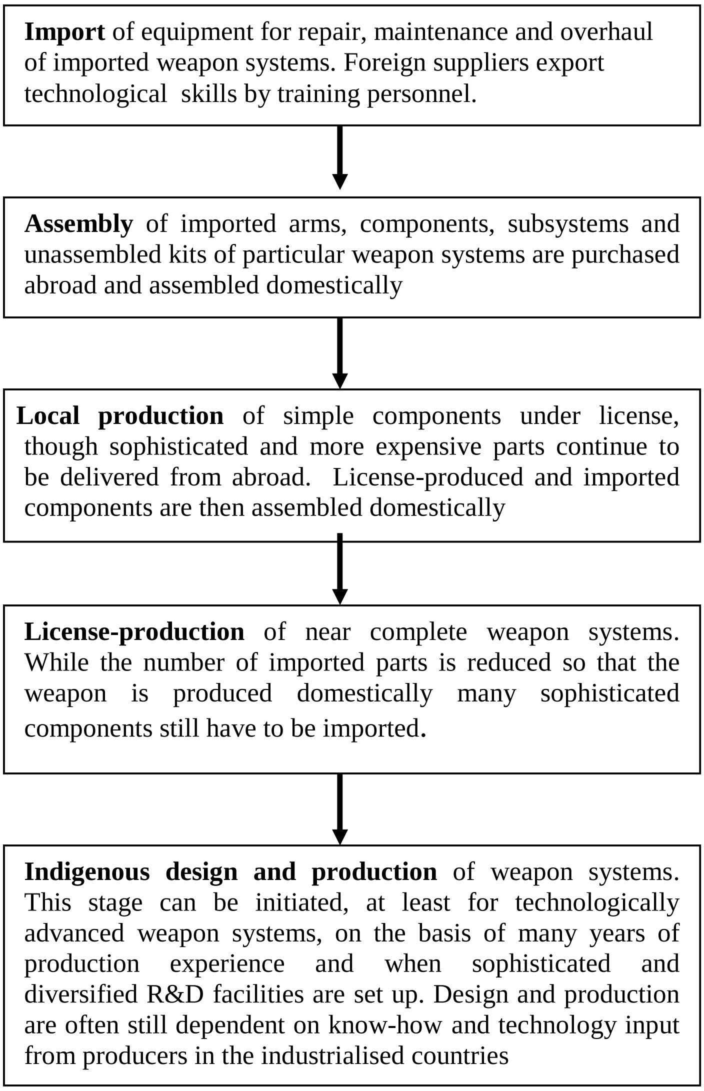
Source: Krause, Keith, Arms Imports, Arms Production, and the Quest for Security in the Third World, *In:* I Brian Job, Ed, *The Insecurity Dilemma: National Security of Third World States*, Lynne Rienner Publication, Boulder CO, 1992, pp.121-142.

Herbert Wulf, when examining developing countries, condenses this process into just five major stages.[23] As shown in Figure 4.1, the process proceeds from off-the-shelf purchase to co-production, licensed production and finally indigenisation. Based on these two writers' models, the Malaysian DIB has gradually progressed from stage 1, off-the-shelf purchase for all major capital items, to stages 2 and 3, with the assembly of armoured vehicles and local production of certain automotive and aerospace components. However the country's defence industrial capability is minimal in stage 4, licensed production, and almost non-existent in stage 5, complete indigenous design and production of weapons.

A different and thought-provoking attempt to define defence industrial capacity is undertaken in the book entitled *Defence Economics* by the defence economist, Gavin Kennedy.[24] His methodology involves calculating what he called the Potential Defence Capacity (PDC), based on the percentage of GDP of seven selected manufacturing sectors. Kennedy argues that arms production requires manufacturing skills and some minimum threshold of capacity, even for the simplest of weapons. The International Standard of Industrial Classification (ISIC) 2004 classifies manufacturing industry into 99 sub-categories. However, most of these categories are not linked to arms production.

Kennedy lists seven categories under the ISIC classification, being iron and steel, non-ferrous metals, metal products, non-machinery, machinery, non-electrical and electrical machinery, shipbuilding and repairing, and motor vehicles; these he views as essential to the development of a defence industrial base. According to Kennedy, armaments, naval craft and aircraft are all heavily dependent on metal trades, metal processing, metal fabrication and metal machining. Manufacturing output from these categories can then be taken as a percentage of the country's total manufacturing capacity to establish its contribution in a country's defence output. The PDC share in total manufacturing capacity can be measured in several ways, including the fixed wage bill for each sub-category, the proportion of value–added, the numbers employed, and the value of output produced.

Figure 4.1: Herbert Wulf's Five Stages of Defence Industrialisation



Source: Herbert Wulf, Arms Production in the Third World, *In: SIPRI Yearbook*, Stockholm International Peace Research Institute, Stockholm, 1985, p.330.

Based on Kennedy's model, Matthews calculated India's PDC for 1974 and compared it to that for 1984, as per Table 4.2.[25] The analysis indicated that India's major capital goods industries made a substantial contribution to manufacturing activity as far back as 1974. All indicators registered an increase, with value-added surging to a remarkable 40 percent, reflecting the growing maturity of India's civil engineering sector. India's PDC was ranked highly compared to other newly industrialising countries engaged in defence industrialisation.

Based on Gavin Kennedy's PDC model, small developing states like Malaysia need to analyse whether they have a viable capital goods and increasingly today, dual-use industries to develop and sustain a defence industrial base.

Table 4.2: India: the Share of PDC in Total Manufacturing

National Industrial Classification	Employment Nos (000)		Gross Output (Rs Crores)		Value Added (Rs Crores)	
	1974	1984	1974	1984	1974	1984
33-Basic metals	421.7	669.4	2636	12854.5	643.4	1862.11
34-Metal products	172.2	196.5	683.5	2170.5	170.9	490.6
35-Nonelectrical machinery	335.5	429.6	1485.6	5941.9	427.4	1608.9
36-Electrical machinery	254.4	353.2	1384.4	5562.0	387.9	1710.8
37-Transport equipment	395.2	521.4	1360.7	5831.8	398.3	1535.6
Total PDC	1579	2170.1	7550.2	32360.7	2027.9	7208
Total manufacturing	5408	6759	24447.2	95989.0	6201.0	17839
Total PDC as % of total manufacturing	29.2	32.1	30.9	33.7	32.7	40.4

Source: Matthews, Ron, Matthews, 'The Development of India's Defence Industrial Base', *The Journal of Strategic Studies*, 4(12), 1989, pp.405-454, *In:*Annual Survey of Industries, 1974-75 and 1984-85, Summary Reports, C.S.O, Government of India. *Industrial Statistics Yearbook 1985*, UN, New York 1987.

4.3 Contextualising Malaysia's Defence Industrial Push

Malaysia's defence policy, its Armed Forces structure and also procurement decisions, are strongly influenced by the political vision of the country's leaders. When Malaysia attained independence in 1957, there was no definitive role for the military apart from assisting the police in the maintenance of law and order, given the absence of external threats and the significant presence of Commonwealth forces.[26] However this scenario changed during the 1963 Malaysia–Indonesia confrontation. That year, *the Yang Di- Pertuan Agung* at the 1975 Parliamentary session declared:

Formerly, the primary role of the armed forces was to assist the police on preserving peace in the country. Today, their primary role is to defend the country against external threat and aggression……..[27]

Britain's decision to accelerate military withdrawal from Malaysia and Singapore, the escalation of Communist activity, post 13 May, 1969, and the Sabah 'Annexation' Act by the Philippines Congress, forced the Malaysian government to take a more serious approach to defence. In 1969, the late Tun Abdul Razak (then Deputy Prime Minister as well as Minister of Defence) emphasised the need '….. to review the whole defence structure…… to formulate new defence arrangements…… in the light of the likely threat, both internal and external, to the security and stability of this region to be more self-reliant as a nation………(and) to meet new additional responsibilities.'[28] This set the tone for Malaysia's defence policy with greater emphasis on 'self-reliance' in defence as well as sustaining a more objective external defence force. Regional instability and uncertainty, following the withdrawal of American forces from South East Asia after the fall of South Vietnam in the 1970s, further increased Malaysia's need to strengthen national security.[29]

In the 1980s, during the tenure of the late Prime Minister, Tun Hussein Onn, defence was allocated one of the largest budgets ever, some RM 7.19 billion or 18.3 percent of overall government budget to modernise and upgrade Armed Forces capability under a special programme called PERISTA *(Perkembangan Istimewa Angkatan Tentera)*.[30] The changing role of the Malaysian Armed Forces from a counter-insurgency force towards acquiring capabilities in conventional warfare to counter external threats required massive modernisation of the Armed Forces.[31] However, the modernisation effort that was put on hold in the mid-1980s, due to economic recession, and was reinstated in the early 1990s by the Malaysian

Armed Forces under the leadership of Tun Dr. Mahathir Mohammad (the fourth Prime Minister of Malaysia). Defence was once again allocated a huge budget under the 8th Malaysia plan, amounting to RM 17,298 million or 10.2% of Malaysia's national budget**.** This high level of defence expenditure was due to the demands of the MAF in preparing to face the new security challenges and modern warfare of the 21st century, in terms of the nature of operations, equipment and technology requirements.[32]

According to Dato' Najib Tun Razak (Deputy Prime Minister cum Minister of Defence) ….. 'there is no definitive clear cut military threat facing the nation today, but the Armed Forces still function at the frontier to tackle the country's sovereignty and territorial integrity.'[33] The Armed Forces are needed to address the security challenges of asymmetric warfare, including terrorism and cyber warfare. Nevertheless, many security analysts claim that Malaysia's immediate security concerns today include territorial claims over the Spratly islands, also claimed by China, Vietnam, Singapore, the Philippines, Indonesia and Brunei. Other major flash points include piracy in the Straits of Malacca, illegal immigrants, kidnapping, terrorism and drug trafficking.[34]

Malaysia's evolving defence policy is thus said to be dictated by its foreign policy but to a large extent foreign policy decisions are idiosyncratic, mostly made by the prime minister in power.[35] The defence policy provides the strategic guidance determining capability requirements, to be later translated into arms procurement planning. Malaysia's defence policy is politically-driven and the country, to date, does not have a defence White Paper defining Malaysia's security concerns.[36] A 1997 MOD document outlined Malaysia's defence policy, based on three basic fundamental principles: national strategic interest; principles of defence; and the concept of total defence.

Based on Malaysia's strategic interest, self-reliance of the Armed Forces became an underpinning requirement for internal and external security of the nation. The nation's strategic interests lies at three different levels: the immediate vicinity, including land territories, territorial waters, exclusive economic zones, the Straits of Malacca and the Straits of Singapore; regional interests including South east Asia, the Andaman Islands and the South China Sea; and Malaysia's growing interest beyond the region due to its growing trade links and increasing foreign direct investment.

Considering Malaysia's strategic interests, its defence centres on the principles of self-reliance, regional cooperation and external assistance. At the core is the principle of self-reliance, emphasising the Armed Forces' capability to act independently without foreign assistance in matters concerning internal security and protecting the territorial integrity and security interests within the immediate vicinity from low to medium threat level. At the same time, Malaysia's closeness to the other ASEAN countries has encouraged bilateral defence cooperation and confidence-building measures through the ASEAN Regional Forum. Despite the country's allegiance to ZOPFAN, Malaysia does seek external assistance outside the region.[37] The one and only formal external multilateral agreement is the Five Power Defence Arrangement (FPDA).[38] The Malaysian Armed Forces (MAF) has translated its defence policy into concepts of defensive defence, comprising deterrence, forward defence and total defence.[39]

4.3.1 Armed Forces Structure, Budgetary Processes and Defence Inventory

The three services of the MAF comprise 110,000 military personnel. The Army has the largest force with 80,000 personnel whilst the Navy and Air Force have 15,000 each.[40] The MOD imposes a five-year planning structure, establishing its manpower levels, equipment requirements and financial ceilings to guide the formulation of annual budgets. The annual budget is divided into a development budget and an operating budget.[41] The government has consistently increased its defence spending to equip the Armed Forces with newer and more modern equipment.[42] Table 4.3 shows the rising trend of Malaysia's defence spending over the past 10 years.

Table 4.3: Malaysia's Defence Expenditure (1995-2006)

Year	Defence Expenditure * in constant (USD)	Defence Expenditure (RM)	GDP (%)
1995	1961	6121	2.8
1996	1886	6091	2.4
1997	1772	5877	2.1
1998	1302	4547	1.6
1999	1762	6321	2.1
2000	1600	5826	1.7
2001	1991	7351	2.2
2002	2263	8504	2.4
2003	2882	10950	2.8
2004	2073	10419	2.3
2005	2363	9039	NA
2006	3008	11070	NA

Source: Stockholm International Peace Research Institute, *SIPRI Year Book*, p.339, 2006.

The MAF's inventory comprises armoured personnel carriers, trucks, missiles, torpedoes, war ships, fighter aircraft, trainer and transport carriers. **Appendix M** provides a full list of Malaysia's defence inventory. Recent purchases under the 8th Malaysia plan[43], as shown in Table 4.4, are mainly part of the on-going modernisation plan with a particular focus on strengthening sea and air power to face the newer global security threats confronting Malaysia as well as the region.[44] The government, however, aims to reduce the size of MAF personnel in the long run and increase the fire power capabilities of the Armed Forces by equipping the MAF with more digitised battlefield equipment.[45]

Table 4.4: Main Projects under the 8th Malaysia Plan (1999-2005)

Service	Equipment
Land	MBT PT91 Jernas Short Range Missile System ACV 300 MLRS Astros II Power pack MIFV Modular Composite Tactical Bridge Floating Bridge Light Observation helicopter IGLA G5 Gun
Naval	MCMV Scorpene Submarine Patrol Vessel Super lynx helicopters Fennec helicopters Exocet SM 39 Exocet MM 40 Black Shark Torpedo
Air	A400M Transport carrier CN 235VVIP aircraft SU-30MKM High Performance Human Centrifuge

Source: Ministry of Defence, Malaysia, 2005

4.3.2 Defence Procurement Planning and Procurement Processes

Malaysia's defence purchases are highly political with defence equipment continuing to be bought from many different countries.[46] Table 4.5 shows Malaysia's major conventional weapons purchases from its 10 largest suppliers (2000-2004).[47] The MOD has short-and long-term defence procurement plans, requiring the respective armed services to prepare their capability requirements and submit them to the Armed Forces Headquarters (AFH). AFH after a series of internal scrutinies by the Development Division of the MOD, send a document to the Economic Planning Unit (EPU)[48] at the Prime Minister's Department for a feasibility study and associated budget consideration. The paper after several reiterations is then sent by EPU to the National Development Council (NDC).[49]

Table 4.5: Sources of Malaysia's Major Conventional Weapons (2000-2004)

Country	Figures (USD)
Germany	165
UK	113
Russia	101
France	19
USA	16
Others	271

Source: Extracted from Appendix 10B, Register of transfer of Major Conventional Weapons, Stockholm International Peace Research Institute, *SIPRI Year Book*, Stockholm, 2006.

The NDC presents the plans for Cabinet approval, which is finally presented for Parliamentary approval.[50] The Cabinet will then let the Ministry of Defence decide on the procurement processes. **Appendix N** shows the seven stages of procurement and explains how defence procurement decisions are made. Almost all of Malaysia's major platforms and sub-systems are purchased off-the shelf, but the government has a keen interest in the development of its local defence industries and emphasises the inclusion of local content and industrial participation in defence equipment purchases from abroad. However, in reality, there is a constant conflict between the need for local content as opposed to the government's emphasis on *value for money* and the Armed Forces' priority for efficiency and effectiveness of the equipment purchased. Further, as the defence policy is not publicly accessible, it is difficult to evaluate arms procurement decisions, or to know whether defence policy fits into the political leadership's perception of strategic planning in a comprehensive and systematic fashion.[51]

4.4 Malaysia's Defence Industrial Policy: Congruence or Contradiction?

The defence industry forms an integral part of the defence capability of any country. In the case of Malaysia, the defence industry is categorised as a 'strategic industry', and therefore its prime purpose is to support the Armed Forces to attain self-reliance. The growth and development of this industry is planned and monitored by the Ministry of Defence rather than the Ministry of International Trade and Industry (MITI). The country does not have a published defence industry policy or defence industry blue-print because a defence policy White Paper has still not been formulated.[52] Malaysia has not possessed a formal approach to arms production since 1957. Defence production was solely in the hands of the government on the pretext of national security. Over the years, the Armed Forces' needs were satisfied through in-house facilities on an *ad-hoc* basis, geared towards the individual needs of each branch of the Armed Forces. There was minimal defence industrialisation due to the absence of policy catering to defence industrial development. In the initial era, industrial participation was completely neglected in both defence procurement and national industrial development plans.

The Malaysian Armed Forces, however, realised that it is crucial to have a capable defence industry during war time. The Malaysian government also recognised that defence industrial capability is crucial in supporting the development of a credible and effective fighting force. A main objective was thus to create a defence industrial base that is credible to provide first-line support to its Armed Forces mainly in through-life support and spares. Malaysia's policy of DIB modernisation is, therefore, gradual, cautious, non-ambitious and pragmatic. The government realised that no country outside the US can afford to have a 'cradle to grave' defence industry in every sector. [53] Therefore Malaysia has consistently reinforced its position by maintaining a defence industrial base that can efficiently and effectively sustain the equipment purchased. The nation's capacity-building focused on through-life support and developing the skills of Armed Forces personnel and defence industry members.[54] The defence industry is also viewed as a source of employment for retired Armed Forces personnel who have been commercially trained whilst in service.

In 1982, the government initiated a formal approach to defence production policy by introducing the National Defence Production Policy (NDPP), the first written framework for the development of the Malaysian defence industries. Under this policy, defence items were classified into three categories, namely, 'strategic', 'essential' and 'non-strategic.'[55] This policy recognised the need for self-reliance in some areas, with government undertaking the production of strategic items while semi-government and the private sector ventured into the non-strategic and essential items. A national Defence Production Committee (NDPC) headed by the Deputy Minister of Defence was set up to oversee the implementation of the NDPP. However, the Committee's efforts to implement the NDPP were disrupted due to the economic recession in the mid-1980s, having a drastic impact on military expenditure. Plans for weapons acquisition and all other defence-related activities had to be put on hold and this also had a direct effect on the implementation of the NDPP. With no new equipment forthcoming, defence industry expenditure was channelled towards extending the shelf-life of existing equipment through upgrades and overhauls. Sadly, the NDPP was completely abandoned in the later days.

The government has taken a strong position on defence industrialisation and views its progress as a *public-private partnership.* Efforts have been made to increase local defence industry capabilities through government initiatives at various levels, including local content requirements and industrial participation through defence procurement and offsets, promotion of defence industrial collaboration through bilateral defence industry and defence science and technology cooperation and the award of long term contracts to deserving local industries.[56] Table 4.6 lists the Memorandum of Understandings signed between Malaysia and other countries reflecting active bilateral defence industry working groups. Many of these working groups have been used as platforms to discuss potential international defence industry collaboration and technology transfer issues.

Table 4.6: Memorandum of Understanding - Defence Industry Cooperation

Number	Country	Working Group
1	Australia	Defence Science, Technology & Industry Cooperation
2	India	Defence Industry Bilateral Working Group
3	Pakistan	Defence Industry Bilateral Working Group
4	Singapore	Defence Industry Bilateral Working Group
5	United Kingdom	Defence Industry Bilateral Working Group
6	France	Defence Industry Bilateral Working Group
7	Italy	Defence Industry Bilateral Working Group
8	Sweden	Defence Industry Bilateral Working Group
9	Brunei	Defence Industry Bilateral Working Group
10	South Africa	Defence Industry Bilateral Working Group

Source: Defence Industry Division, Ministry of Defence, Malaysia, 2006.

There are also continuous efforts to encourage dual-use technology for industrial growth as the country's defence industrial base is small. A dual-use strategy is employed to assist these industries to adapt to changes in supply and demand and keep production lines active. The government's aim is to maintain a diversified industrial base as a priority policy option.[57] As most of the country's major defence platforms are bought from overseas, the government requires local defence industry participation during the initial planning stages, though there is always a battle between quality and performance of the equipment and national economic development aspirations. The government has been leveraging defence purchases to develop in country human skills of both the Armed Forces and the defence industry, particularly in first- to third-line maintenance, repair and overhaul

(MRO), upgrades, retrofits, basic assembly, systems integration and logistics systems.

In recent years, Malaysia has also viewed the defence sector as a vehicle to acquire high-end defence and aerospace-related technology that could alleviate the country's low technological level. This could then indirectly create spin-offs, such as high value-added employment, indigenous technological and industrial development, skills development and penetration into the global supply chain. The government's initiative to incorporate the need for high technology and value-added activities, as well as highly skilled manpower, was reflected in its national development goals, including the New Economic Policy, the Industrial Master Plan, privatisation, contractorisation and Vision 2020. Interestingly, despite the absence of a written defence industrial policy, the government aims to create a developed nation by the year 2020, with fully developed technological and industrial capabilities and highly trained human resources.

4.5 Tracing Malaysia's Defence Industry Origins

Malaysia's defence industrial base started to develop much later than many of its neighbouring countries, such as Indonesia, Singapore, the Philippines and Thailand. The country's defence industrial base has advanced in the past twenty years due to the government's strong drive to promote a home grown defence industry capable of supporting the nation's tri-services.[58] Although Malaysia's defence industry is viewed as a strategic sector and forms part of the country's defence policy, the reality is that the industry's origins and growth are closely linked to the country's overall Industrial Master Plan[59] and import substitution strategies.

Malaysia hardly had any active industrial development programme before Independence in 1957. There existed only pockets of small enterprises generally owned by Chinese, with larger enterprises dominated by foreigners, mostly British.[60] This situation changed after Independence when the government started encouraging industrial development to promote greater diversification and growth in national output.[61] In the 1960s and early 1970s, there was a political will to drive Malaysia down the import substitution strategy route,[62] trying to create the demand for domestic production with the intention of reducing exports due to the steady worsening of the country's terms of trade.[63] Yet this ISI strategy was not applicable to the defence industry sector *per se*.

During the initial development stages, Malaysia viewed ISI in the defence sector as providing the educational effects of learning by doing.[64] Malaysia's defence industry was very much a government-led initiative, with most of the defence production facilities operating within the Armed Forces domain. Until the late 1980s, defence industrialisation had been minimal, and there were no significantly important production plants.[65] The government's focus centred on three main sectors, aerospace, maritime and ordnance.

In the mid-1980s, Malaysia decided to embark more aggressively on an ISI policy focusing on heavy industrialisation in line with the government's launch of the Industrial Master Plan[66]. The Mid-term review of the Fourth Malaysia Plan (1981-1985) stated that:

The government has been promoting the development of heavy industries in order to strengthen the foundation of the manufacturing sector. Heavy industries are needed to create new engines of growth and to provide strong forward and backward linkages for the development of industries. Heavy industries can also have substantial effects on the growth of small-scale industries if efforts are made to establish linkages and integrate small scale industries development with heavy industries.[67]

The general concentration on heavy industries, mainly the basic metals industry, including iron and steel and non-ferrous metals, machinery and equipment, general engineering, transport equipment and petro-chemicals, had a profound impact on defence industrialisation. The need for force modernisation under PERISTA 2 and also the government's strategy to privatise and corporatise many of its defence facilities gave birth to several defence prime contractors. Despite this industrial push, much of the defence industrial capability remained shallow and heavily engaged in maintenance, repairs and overhaul (MRO) type of work, with minimal in country assembly, co-production and licensed production work.

A further phase of defence industrialisation started between the late 1980s and mid-1990s, with Malaysia commencing another set of Armed Forces modernisation programmes. In the early 1990s, Malaysia's need for defence industrialisation grew stronger for several reasons. The country realised that other developing countries were heavily engaged in defence industrialisation and were far ahead by this time. Brazil, Turkey and India, for instance, were able to manufacture their own platforms. Nearer to home, Indonesia and South Korea were also heavily engaged in arms production. Singapore grew strong in MRO capabilities and was able to become the regional aerospace service centre. Malaysia viewed this progress closely and did not want to be left behind in terms of defence industrialisation. Politically, Malaysia was trying to position itself as a strong and economically progressive country in South East Asia and wanted to acquire defence production capability to demonstrate self-reliance by its Armed Forces. At the same time, Malaysia also realised that the defence industry was a crucial means of acquiring high technology, and a strong and capable industrial base is a prerequisite for absorbing imported technology. Investing in the development of defence technology is costly and involves research and development as well as highly skilled human resources. Arguably, the best way to acquire these technologies is through a defence industrial strategy.

This was also an era when Malaysia was enjoying rapid civil industrialisation. This strength was used as an advantage to attract some of the civil-related companies to venture into the defence sector. Many of these companies, like DRB-HiCOM and Sapura Telecommunications, had strategically formed a defence focus within their organisations. Malaysia viewed the dual-use technology path as a more viable option for local defence industrialisation. This was mainly because the requirements of its Armed Forces were generally too small for viably setting up of facilities solely dedicated to defence production. Therefore, many of Malaysia's defence companies have taken the safe approach by catering to both defence and civil markets at the same time. This worked well during the economic downturn and associated defence budget cuts, allowing these industries to immediately re-strategise and concentrate on civil markets. Today, the government focuses on the defence and aerospace sectors as a source of high technology. [68]

Malaysia applies a strong interventionist policy towards the development of its defence industry. The government has adopted a policy of nurturing and supporting the industry up to the point of which local companies are able to support themselves. According to the Minister of Defence, Malaysia, Dato' Seri Najib Tun Razak:

To realise the goal of self-reliance in defence production and product support for the Malaysian Armed Forces, there is a need to develop our local defence industry in an orderly and systematic manner. There is a strategic consideration to be taken into account and there is also an economic factor that we cannot ignore. Therefore, there is a need to have close interplay between the Malaysian Armed Forces, i.e. the user, the local defence industry, the supplier, and the government agencies, which will facilitate in the areas of government funding, transfer of technology, tax incentives etc. [69]

4.6 Defence Industrialisation and the Role of the State

The State has been influential in promoting Malaysia's defence industrial base despite internal struggles: fulfilling the objectives of the Armed Forces in terms of quality and operability of equipment and at the same time adhering to the Treasury's requirement of keeping the costs of equipment low. The government realises that the DIB sometimes overshadows factors of economic efficiency and effectiveness within the overall economy, a cost to tax payers.[70]

There are several government agencies and defence organisations responsible for the development of Malaysia's defence industry. The Defence Industry Division

(DID), formed in 1972, is the key Agency overseeing Malaysia's defence industrial progress. This Division situated within the Ministry of Defence, is headed by an Under-Secretary, and has four main units: Defence Industry Development; Offsets; Defence Industry Bilateral; and Defence Exhibitions and Privatisation.[71] The main aim of the DID is to oversee Malaysia's defence industry development through active participation and promotion of the defence sector locally and abroad through bilateral platforms and defence air shows, as well as assisting and preparing the industry to face current and future challenges.[72] The Department tries to promote and assist joint ventures and export markets through bilateral defence industry cooperation and defence exhibitions worldwide.

The DID's efforts are supported by the Defence Industry Council (MDIC),[73] a private sector initiative, begun in 1990[74] to promote defence industrialisation in Malaysia. The MDIC is chaired by the Minister of Defence, with representations from various government and semi-government agencies, as well as defence companies. It is focused on steering orderly development of the defence industry, taking into consideration the objectives of the government, as well as that of the nation as a whole. The MDIC consists of six sectors; namely; aerospace, maritime, automotive, weapons, ICT, and common-users. Each sector is headed by an industry member, hand-picked and nominated by the Minister of Defence. The key objective of this council is to meet at least twice a year and to use this platform to discuss various issues that could assist in defence industrial development. This forum has been instrumental in formulating various policies that assist Malaysian defence company progress. The MDIC council has also acted as the platform for open discussions on defence industry-related issues. The council's support has been the backbone to DID's efforts in promoting the Malaysian defence industry sector.[75] The Council has been responsible for formulating several important policies in support of local defence industries, including long-term contracts, offsets policy and the defence industry blue-print. However, some observers see the Council as nothing more than a 'talking shop.'[76]

As defence technology and R&D are important elements in the development of the defence industry, the government set up in 1968 a Defence Research Organisation called the Defence Science Technology Centre (DSTC) within the Ministry of Defence. DSTC has grown from an organisation of 182 people, to one with a total staff of 520.[77] This organisation was renamed as STRIDE[78] or Science, Technology and Research Institute for Defence in 2002. STRIDE's task is to supply scientific and technical expertise to the MAF. The Agency has collaborated with several defence companies and universities on defence R&D projects. STRIDE's concern has always been the lack of government funding for defence-based R&D.[79] In 2002, a joint research fund was set up between STRIDE and the Malaysian Defence Industry Council members under the mandate of the MDIC to collaborate on defence R&D projects. Further, a body called the Intensification of Research in Priority Areas (IRPA),[80] the national R&D organisation, within the Ministry of Science and Technology, also provides support to defence R&D but sets a low level of priority to defence-related R& D research projects due to their lack of both commercial value and dual-use application.

The government has also sought to develop the civil aerospace sector, providing the vehicle for defence-related aerospace industry to spread its base. A special aerospace related agency called the Malaysian Industry Government Group for High Technology (MIGHT) [81] was set-up to plan and monitor the progress of the aerospace industry. The organisation was initially part of the Prime Minister's Department but is now currently part of the Ministry of Science and Technology. MIGHT updates on the progress of the aerospace defence industry in Malaysia. Since April 2004, MIGHT has also been appointed by the Ministry of Finance as the Technology Depository Agency (TDA). TDA's primary role is to ensure that technology acquisition meets the country's development objectives. TDA, therefore, compiles the country's technology wish-list and links these needs to government acquisitions. [82]

Additionally, the Malaysian Aerospace Council was formed to oversee the development of the aerospace industry, including defence aerospace. The objective of this council is to monitor the overall development plan of the national aerospace industry, providing guidelines and identifying priority areas.[83] Linked to the Development Plan, is the 1996 Aerospace Blueprint.[84] The blueprint sets the vision and development strategy for the Malaysian aerospace sector. This blueprint takes into consideration the development of indigenous companies catering for both the defence and civil sectors.

Other government agencies, such as the Economic Planning Unit, the Treasury and Ministry of International Trade and Industry (MITI), as well as the Malaysian Industrial Development Authority (MIDA), closely monitor and facilitate progress of the Malaysian defence industry.[85] The Treasury imposes local content on purchases of big ticket investments. This is to ensure that local manufacturers, with the capabilities and infrastructure, are given opportunities to obtain work from overseas suppliers, wherever possible.[86]

The most recent development has been the proposal to form the *Defence Industry Blueprint* under the MDIC. The objective of the blue-print is to put in place a systematic plan for defence industrial development, as opposed to an *ad-hoc policy,* with a lack of planning on the promotion and development of strategic industries. The proposed blueprint has recommended five thrusts, namely, human resource and competency development, technology development, industry development, domestic defence procurement and international marketing, with 23 key initiatives.[87] This blueprint, when published, will be the first strategic guidance towards the development of a structured defence industry base in Malaysia.

Despite the presence of various governmental and semi-governmental agencies in support of Malaysia's defence industry development, most of these agencies operate in isolation without any strategic or coherent plan under one umbrella organisation, overseeing and monitoring defence industry development. In the past, this has created complications in terms of work duplication, creating differing objectives and strategies. The Ministry of Defence, however, tries to guard jealously defence industry activities, claiming they are an important task of the

Ministry. Further, there are lingering issues pertaining to the follow-up of the policies by the relevant organisations involved.

4.7 Malaysia's Defence Industry: Structure and Capabilities

After more than thirty years of defence industrial ventures, the number of Malaysian defence companies has quadrupled. Table 4.7 below shows the growth in the numbers of defence companies in Malaysia. The defence industry started off as a pure government-based initiative with the formation of a few companies, mainly in aerospace and weapon production in the 1970s. These companies were mainly government-owned with facilities in the military environment. This pattern changed in the early 1980s when several of the government-owned companies were corporatised or privatised in-line with national privatisation policy initiatives. Since the early 1990s, most of the firms have become fully private firms. Further, there is an increase in the number of ICT and aerospace-related defence companies. This is due to Malaysia's focus on the aerospace sector, as a stepping-stone into high technology and civil manufacturing industry, particularly, the electronic and electrical sectors.

Whilst there has been an increase in the number of defence companies in Malaysia, the question remains as to the depth and capability of the defence industry to undertake work beyond maintenance, repair, overhaul and low-end manufacturing of parts and components.[88] Although Malaysia has been developing its defence industry across 30 years, the government and industry feel strongly about the lack of capabilities in major areas.[89]

As shown in Table 4.8, below, the Malaysian defence industry seems to have performed better in manufacturing and MRO activities; some of the defence companies even managing to penetrate the global supply chain in a more challenging environment, where prime contractors have the potential to exploit their vertically integrated positions to win an increasing share of business. However, most of these companies possess only medium-level expertise in assembly work. The overall industry has only attained low levels of capability in research, development and design work.[90] Only a handful of these companies have been able to enhance their capabilities to become international players.

Table 4.7: Expansion of Malaysia's Defence Industry (1970-2000)

1970-79		1980-89		1990-99		2000-	
Company	**Sector**	**Company**	**Sector**	**Company**	**Sector**	**Company**	**Sector**
Aircraft Repair and Overhaul Depot (1976)	Aerospace	AIROD (1984)	Aerospace	SMEA (1992)	Aerospace	Boustead Naval Dockyard (2005)	Maritime
Syarikat Malaysia Explosives Sdn Bhd (1972)	Weapons	Caidmark (1980)	Aerospace/ ICT	Zetro	Aerospace	Labuan Shipyard	Maritime
Tenaga Kimia (1976)	Weapons	ME&O (1985)	ICT	ATSB	Aerospace		
System Consultancy Services (1975)	ICT	SMEO (1993)	Weapons	CTRM (1991)	Aerospace		
		MMC Defence (1986)	Automotive	Ikramatik (1999)	Aerospace/ ICT		
		PSCNDSB (1995)	Maritime	DRB Hicom/ DEFTECH (1996)	Automotive		
		D'Aquarian	Maritime				
		ATSC	Aerospace	Sapura Defence (1995)	ICT		
		SMEAv	Aerospace				
				UPECA (2005)	Aerospace		

Source: Malaysian Defence Industry Council (MDIC), registered members, 15 May 2006; www.mod.gov.my

Many defence companies maintain close ties with the government and are highly dependent on the Malaysian Armed Forces for continuous business. The MOD is thus the largest customer of these local companies for which the total contract value in 2005 from MOD for through-life support of equipment for the three services was RM 646.15 million.[91] Of late, due to increasing international economic pressure, many local companies have opted to diversify their markets towards a dual-use strategy, instead of solely depending on defence. Many companies have set up defence-based subsidiary companies within their overarching commercial businesses.

Table 4.8: Malaysia's Current Defence Industry Capability, 2006

Capability Sector	R&D	Design	Manufacturing	MRO/ Overhaul	Integration	Assembly	Prime Company
Aerospace	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	Airod, SME-A, CTRM, Excelnet, IKramatik
	Low	Low	High	Medium	Medium	Medium	
Automotive	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	DRB-HiCom MMC Defence Pesaka Astana
	Low	Low	Medium	High	Medium	Medium	
Maritime	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	PSCNDSB, MSE Eng Sabah Shipyard
	Low	Low	Low	High	Low	Medium	
Weapons	**Y**	**Y**	**Y**	**Y**	**N**	**Y**	SMEO
	Low	Low	Medium	Medium	N/A	Medium	
ICT	**Y**	**Y**	**N**	**Y**	**Y**	**Y**	Sapura SCS Zetro
	Low	Medium	N/A	Medium	Medium	Medium	

Source: Ministry of Defence, Malaysia, 2006. [92]

4.8 Malaysia's Defence Industry Development

According to a report by the MDIC,[93] 28 out of 52 members are representatives from Malaysia's defence industry, comprising the six sectors of aerospace, maritime, weapons, automotive, information, communication and common-users. However, not all members of the MDIC are established defence companies, possessing research and development facilities, infrastructure and human resources. Some are merely trading companies or agents, mainly involved in spares or management consultancy.[94] **Appendix O** presents a comprehensive list of Malaysian MDIC members and core businesses. Figure 4.2 below, shows the six sectors that will be examined in detail in this section. The discussion further explores the sub-sectors within each main sector, according to the type of activity.

4.8.1 Aerospace Sector

Within the defence industry, the aerospace sector is arguably the most successful with 'spin-offs and spin-ons'.[95] The Malaysian government believes that the aircraft industry could move Malaysia's technological and industrial capability forward. There are a handful of Malaysian aerospace companies that specialise in design, manufacturing and maintenance of aircraft.

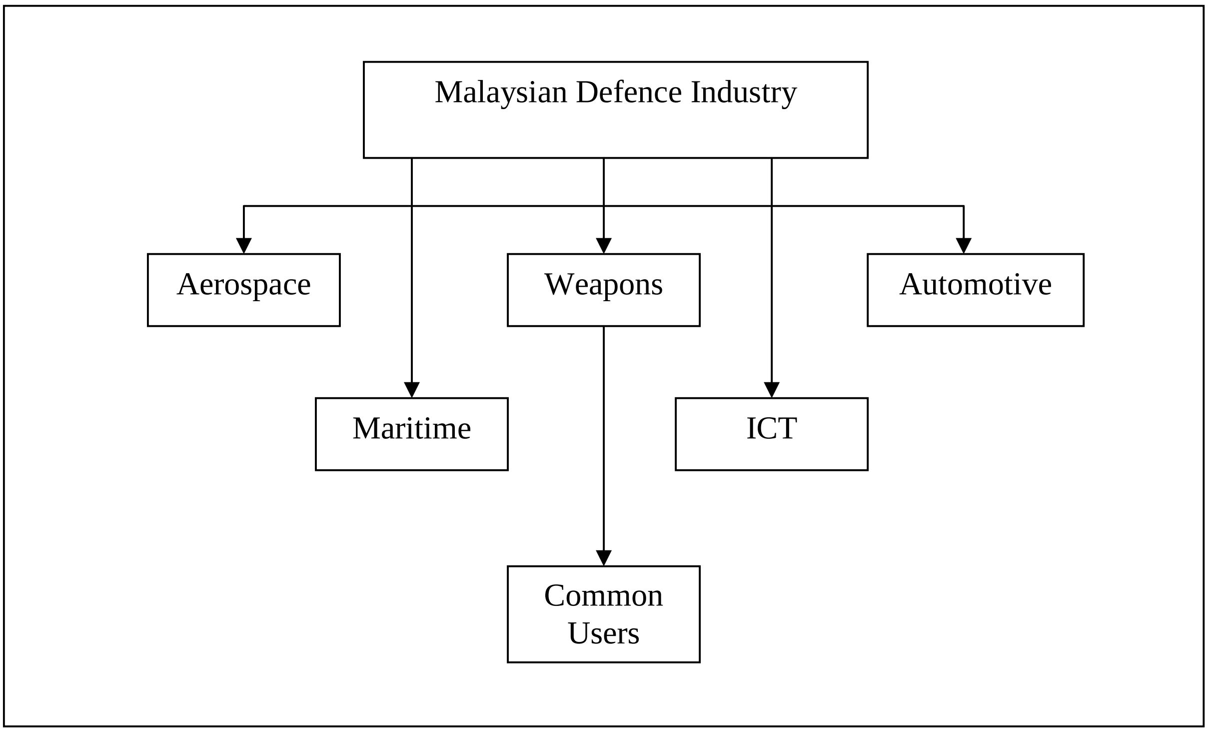
4.8.1.1 Design

In terms of aerospace design capability, the nation is still inexperienced, and only a small number of Malaysian companies are specialised in this area. One of them, *Excelnet*, a design house, started operations in 1998. [96] Excelnet is equipped with engineers specialising in computer Aided Design/ Computer Aided Manufacturing (CAD/CAM) and Stress Analysis Software, undertaking design work for the BAES Nimrod MRA4. Some of this company's projects include managing the wing spar modification of the Scottish Aviation Bulldog wing life extension. Excelnet also claims that through aircraft design work, the company has been able to spin-off knowledge gained in other sectors, such as the civil automotive and marine industries.

4.8.1.2 Manufacturing

In terms of manufacturing capability, a few Malaysian-based defence companies have been successful in securing international contracts for the manufacturing of aircraft parts and components. A pioneer manufacturing facility is the Armed Forces Manufacturing Workshop. This was set up in 1978 with the aid of Australia to produce a variety of aerospace components. The Armed Forces Manufacturing Workshop is capable of manufacturing parts for various equipments used by the Armed Forces and producing a wide variety of machined components. It also undertakes fabrication-welding, plastic moulding and auto-reclamation. Today, other Malaysian companies have qualified to become 3rd tier suppliers of aircraft parts, components and specialised services.[97]

Figure 4.2: Six Sectors of the Malaysian Defence Industry Council



Source: Author

SME Aerospace (SMEA) is a Malaysian company that started life in 1992 solely as a defence business. The company, formed through an offsets initiative, manufactures aerospace parts, components and sub-assemblies. *SMEA's* initial venture was the manufacture of Hawk pylons for BAE Systems. SMEA, over the years, has built-up its capability in the manufacturing of aircraft parts and components to become part of BAES' global supply chain. *SMEA*, with a workforce of 448, based in Sungai Buloh, claims to have capabilities to manufacture Airbus fixed leading-edge metallic parts and components, Airbus sub-spar assemblies, RJ wing leading-edges, Airbus aft pylon fairings, sono-buoy racks and stairs, crew and troop seats and helicopter vertical and horizontal fins. The company also claims to be competent and internationally competitive in securing work packages based on the price and quality of work.[98] *SMEA* started off as a defence manufacturing company, but today has managed to diversify its business and move into the commercial aerospace sector. The company's CEO, Colonel (Rtd) Chee Ng Boon, mentioned that *SMEA* will in future emphasise a more practical dual-use strategy, which in the long-run will help the industry sustain its business and increase its competitiveness.[99]

UPECA Engineering Sdn Bhd (UPECA's) defence and aerospace business is a spin-off from *SMEA*. This company was formed in 1990, and is civil-oriented, primarily in the oil and gas sectors. SMEA has sub-contracted some of its work, mainly in the production of high precision parts, tools and dies, jigs and fixtures, aircraft parts and automation systems to *UPECA*. The company, through its civil aerospace experience, has moved into the defence sector by securing work to produce high-precision parts for the A400M. Although metal-based parts and components manufacturing in Malaysia has not involved primary aircraft structures, *SMEA* and *UPECA* claim to have the capability to fabricate relatively complex aero-structural parts requiring up to five axis CNC machining.

Composite Technology Research Malaysia (CTRM) has, since its inception in 1991, been mainly involved in civil aerospace, such as the production of the Eagle and the UAV performance Lancair Columbia 300. *CTRM's* subsidiary company, Asian Composite Manufacturing *(ACT)* was formed in 2001 and ventured into composite manufacturing. ACT designs and manufactures various components for the Airbus 320 and 380, worth more than RM 1.4 billion. [100] ACM is also the sole supplier of fixed trailing edge panels for the B747, 757 aircargo, 767 and 777 aircraft.[101] *CTRM* recently moved into the defence sector when the company was awarded the contract from BAES to design and manufacture airframe parts worth RM 907 million for the A400M.[102] CTRM also pursues a dual-use strategy and has been successful in undertaking both defence and aerospace work using composite manufacturing technology.

SME Aviation, a subsidiary of the NADI group, was initially set up with the sole purpose of building the MD3 aircraft; the first Malaysian made commercial aircraft. The project was a joint-venture between *SMEAv* and BAES under an offsets programme linked to the purchase of the Hawk aircraft. However, since the ending of the MD3 project, *SMEAv* has restructured its strategy to become a MRO centre for both commercial and military aircraft. [103]

4.8.1.3 Maintenance, Repair and Overhaul (MRO)

MRO capability is the oldest and most established activity within the defence aerospace sector in Malaysia. This is because most of the companies were initially set-up to provide immediate first- and second-line service to the RMAF before the OEMs arrived. Eventually, some of these companies upgraded their capacity to become regional service centres for defence and non-defence based aircraft. The earliest defence-related aerospace company, specialising in MRO activity, was the Aircraft Repair and Overhaul Depot *(AIROD)*, being set up in 1976 to cater for the RMAF's needs. Prior to privatisation, *AIROD* had serviced some of the main RMAF aircraft, such as the C-130, F-5, A-4 Skyhawk, PC-7, Caribour aircraft, S-61 and Aloutte helicopters. *AIROD* also undertook repair and overhaul work on the T-58, J-85 and Astoute engines. Under- utilisation of AIROD facilities prompted the government to privatise this facility in 1985 as a joint-venture between Aerospace Industries Malaysia Sdn Bhd and Lockheed Aircraft Services International.

AIROD's capability was initially limited to the servicing of aircraft engines, accessories and avionics for both military and civil aircraft. *AIROD* was the pioneer in providing maintenance facilities to support the Royal Malaysian Air Force in areas such as engines, aero-components and avionics. In 1984, *AIROD* was incorporated as a private limited company, jointly owned by Aerospace Industries Malaysia (AIM), otherwise known as the National Aerospace and Defence Industries (NADI), and Lockheed Aircraft Systems, US. However, by 1995, *AIROD* had become a fully Malaysian-owned company, with 90% of its ownership controlled by *NADI* and the other 10% by the Malaysian government.[104] Of late, *AIROD* has become a wholly-owned subsidiary of *NADI.*

AIROD specialises in maintenance, repair and overhaul of air components, and also engages in aircraft upgrades and refurbishment. *AIROD* has grown from a workforce of 152 and 10 managers to employing over 1,200 workers, mainly highly qualified and experienced aviation engineers. A large number of *AIROD*'s workforce includes retired RMAF personnel. The company's facilities[105] located in Subang have expanded with the capacity to undertake both military and commercial maintenance work, diversifying its business to sustain continuous workflow for its workers.[106] In the military sector, the company currently services the RMAF and a few other military aircraft in the region, such as the Indonesian Airforce, Royal Jordanian Airforce and the United States Air Force (PACAF). *AIROD* has also ventured into the manufacturing of wire-looms and assemblies.

Another company involved in services work is *Aerospace Technology Systems Corp Sdn Bhd (ATSC).*[107] ATSC with its partners, Rosoronboronexport and RAC 'MIG', have facilities in Pekan, Pahang. The company was formed mainly to support and enhance MIG-29 aircraft in repair and overhaul, technical services, upgrading and modification as well as through the distribution of spares and materials. *ATSC*'s workforce is largely ex-RMAF personnel, with experience in aircraft maintenance and engineering support. *ATSC* has been actively engaged with other countries, such as Germany and India, which have also undertaken MIG-29 maintenance work. Presently, *ATSC* is providing a defence maintenance and repair service, particularly for the RMAF's MIG-29 aircraft. With the ageing MIG aircraft, coupled with newer aircraft, such as the SU-30 MKM, questions remain as to the viability and relevance of this service centre, without the servicing of newer aircraft by *ATSC* to ensure sustainability.

Zetro Aerospace Corporation was formed in 1981 to deal primarily with the supply of parts and components for the RMAF. However, its function changed when Zetro Engineering was formed to provide services in the area of aircraft avionics maintenance. Zetro has the capabilities to maintain, repair and overhaul avionics components, to integrate avionics systems, maintain, repair and overhaul ground electronic components and to test and commission radar systems. Zetro has entered into various partnerships with foreign companies to upgrade its facilities and be recognised as an established regional avionics centre. Zetro, with its capabilities acquired through defence work, has moved into avionics maintenance for civil aircraft. Zetro enjoys a partnership with Eurocopter Malaysia, a wholly-owned subsidiary of EADS, in the servicing of aerospace electronics for Eurocopter helicopters. [108]

Other players in the aerospace sector include Caidmark, Aeronautical Technology Sdn Bhd and Ikramatik. Caidmark, for example, has capabilities in reliability-centred maintenance analysis and conditioned-based monitoring. The company has been appointed by the RMAF as its authorised service provider for majority of MAF aircraft.[109]

4.8.2 Weapons Sector

Although Malaysia's weapons industry was one of the country's earliest defence sectors, the industry has not grown beyond catering for the basic needs of the local Armed Forces. Syarikat Malaysia Explosives Sdn Bhd *(SME)* was set up in 1972 to produce small arms ammunition, hand grenades and pyrotechnics. It started as a joint-venture with the Government of Malaysia and two European defence producers, Nobel of Sweden and Oerlikon Machine Tool Co of Switzerland. Some of *SME's* subsidiaries include Tenaga Kimia Sdn Bhd, SME Tools Sdn Bhd and SME Trading Sdn Bhd. Tenaga Kimia was incorporated in 1976 as a joint venture with Nitro Nobel of Sweden to produce emulsive explosives. SME Tools manufactures precision tools and parts, including plastic molds, engineered plastic products and ground support tooling for both military and civilian consumption.

SME Trading (later known as SME Technologies) is the trading arm of the Group that undertakes production of precision machines tools and plastic moulding. In 1989, *SME* signed an agreement with Steyr-Mannlicher of Austria to produce and sell the Steyr-AUG assault gun for the Malaysian Armed Forces.[110] *SME Technologies* obtained the license from an Austrian-based company to produce the Steyr for the Malaysian Armed Forces. The business did not flourish, however, and was later dissolved, with production taken over by SME Aerospace. Recent developments indicate that the entire production plant has shut down, and the Steyr machine gun is no longer produced in Malaysia, following MAF's decision to change weapons requirements.

The Malaysian weapons industry faces difficulties due to the lack of export markets as well as low demand domestically. The only thriving weapons producing Malaysian company today is *SME Ordnance*, a subsidiary of the NADI group**.** SME Ordnance Sdn Bhd (SMEO) was formerly known as Syarikat Malaysia Explosive Sdn Bhd. Its present name came into effect on 5 March, 1993, to better reflect its expanding business into the manufacturing of defence products. SMEO is the only licensed manufacturer of ammunition in Malaysia and has been identified by the government as the Agency responsible for the development of defence products.

SMEO was incorporated in 1969 as a joint-venture company with equity participation between the Government of Malaysia, Dynamit Nobel of Germany, Oerlikon Machine Tools Co of Switzerland and two local Malaysian partners, namely Syarikat Permodalan Kebangsaan and Syarikat Jaya Raya Sdn Bhd. However, by 1974, the Government of Malaysia acquired all the shares and *SMEO* and it became a wholly-owned Government company. *SMEO* initially began operations as a manufacturer of small calibre ammunition and progressed to develop a range of pyrotechnic, large calibre ammunition and engineering plastics products. The company is also involved in refurbishing a wide range of ammunition and the provision of Non-Destructive Testing (NDT) services. In 1993, *SMEO* was approved as a preferred supplier of Guns and Ammunition to the Royal Ordnance Division, BAE Systems.[111] *SMEO* is also involved in the manufacture and assembly of various types of ammunition, such as small and medium-calibre ammunition, pyrotechnics products, shotgun cartridges, large calibre ammunition, and lead products. *SMEO* is today a wholly-owned private company.

4.8.3 Land Systems

Malaysia's rapid development of the civil automotive sector in the early 1980s did not have a similar impact on the defence-related automotive industry.[112] Malaysia's defence-related automotive industry is focused on three major players, DEFTECH, MMC Defence and Pesaka Astana. At the initial stages of development, each company was designed to specialise in a particular type of production so as not to overlap in the small market. *DEFTECH,* a subsidiary of DRB-HICOM Bhd, was established in 1996, specialising in the manufacture, supply and maintenance of defence-related equipment, particularly soft skinned vehicles below three tonnes.[113] The first major in country project for DEFTECH was the joint development and local assembly of 64 Turkish APC 300s. Through this project DEFTECH was able to obtain technology know-how, including production and process technologies and equipment such as jigs, tools and documentation of processes. From this know-how, *DEFTECH* has been able to manufacture trucks for export. Today, *DEFTECH* exports dual-use trucks to countries like Bangladesh and Brunei.

MMC Defence is a subsidiary of the MMC Engineering Group and specialises in the production of armoured vehicles.[114] The company is a pioneer in the defence automotive sector, being formed in 1986 and having a huge infrastructural facility based in Nilai, Negeri Sembilan. *MMC* was mandated by the Malaysian Armed Forces to carry out activities in armoured vehicle technology, including maintenance, overhaul, upgrading, spare parts management and related research and development. *MMC* has successfully carried out prototype development of the

Commando V150 dieselisation project. This was followed by the modernisation of first, the 100 petrol-driven Ferret Scout Cars, and secondly, the 110 MT turbocharged diesel engine on a Chrysler A727, which is a fully automatic transmission, replacing the old petrol engine and semi-automatic transmission.

In 1993, the Army awarded *MMC* a contract to overhaul 96 Thysen Henschell Radpanzer Condor 4x4s involving total refurbishment, including overhaul of the engine, axle, transmissions, hulls and turrets. The three-year contract was completed in 1996. In 1997, the Army awarded the company another contract to refurbish an additional 150 Condor 4x4s which was successfully completed in 2000. In 2003, MBDA selected *MMC Defence* as an industrial partner in South East Asia after a thorough auditing process to design and manufacture the missile rack for the Jernas SHORAD system. According to *MMC Defence* personnel, this contract was a breakthrough for MMC Defence allowing it to embark on more diversified defence industrial activities.[115]

MMC Defence went one step further in 1995 by undertaking R&D programmes for life extension and upgrade of the Scorpion and Stormer Armoured Personal Carriers, involving the general overhaul of the vehicles and upgrading of the suspension and turret systems. The vehicles have successfully undergone stringent trials and evaluation tests conducted by the Malaysian Army. In 2000, MMC Defence successfully converted a Stormer APC into a Command Vehicle. The Malaysian Government appointed *MMC Defence* to receive technology transfer linked to the Korean Infantry Vehicle from its manufacturer. The technology transfer package involves on-the-job training of the company's staff conducted in Malaysia, Bosnia and Korea, covering fourth-line repair work on the vehicles. *MMC Defence* was also nominated as the prime beneficiary and local partner for various activities, including transfer of technology, local assembly, maintenance, spare parts management, manufacturing and related activities as stated in the contract for the purchase of Main Battle Tanks (MBT) from Poland. For this, *MMC Defence* sent a team of selected staff to Poland to study the technicality and engineering components of the MBT under a transfer of technology agreement. *MMC Defence* has also established technical collaboration with several international suppliers such as ALVIS (UK), Thyssen Henschell (Germany), Bumar Labedy (Poland), Daewoo (Korea) and Cadillac Gage (US). Currently, *MMC Defence* is one of the few Malaysian companies focusing purely on defence work.[116]

Another important player in the land systems area is *Pesaka Astana*. The company produces specialised vehicles under the brand name AMDAC. The company has manufacturing plants in Romania and Korea. *Pesaka Astan*a caters to both the defence and civil market. Currently its clients include the Ministry of Defence Malaysia (MINDEF), the mining industry, fire and rescue departments, port and airport authorities and municipals. *Pesaka Astana* has technical partners worldwide, such as MAN, ALLISON, Detroit Diesel, Iveco-Magirus (Germany), CNIM (France) and Chase Enterprise (Thailand). The products manufactured and supplied include 4 x 4 to 8 x 8 vehicles, such as gun towers, troop carriers, missile loaders, bulk refuellers, tactical floating bridges, DROPS vehicles, turntable ladders (TTL), rapid fire rescue tenders (RFRT) and port terminal tractors. Recently, *Pesaka Astana* formed Daesung Marine Technology Co, Ltd (DSMT) in Korea to jointly develop the AMDAC Waterjet Propulsion System for the South Korean Navy. Overall, the Malaysian defence land systems industry struggles to maintain an attractive export market that is low cost and high quality. The land systems companies would rather maintain a civil automotive business with some defence work to sustain their businesses.[117]

4.8.4 Maritime Sector

In the maritime sector, one of the early developments was the 1953 formation of the Malaysian Shipyard and Engineering Sdn Bhd (MSE) based at Pasir Gudang, Johor. It began as a joint venture between the Malaysian government and a number of foreign and local companies. The Korean-designed offshore patrol vessel (OPV) of the RMN, the 300-tonne KD Marikh, was built by MSE in 1984. Four dockyards also had significant roles in the development of the maritime industry.

These dockyards are the Hong Leong-Lurrsen Yard, MARA Shipyard, Penang Shipbuilding Company and the Lumut Dockyard.

The *Lumut dockyard*, built in 1984, became Malaysia's principal dockyard, and was later privatised so that its capability could be extended beyond the needs of the Malaysian navy to provide for non-government and commercial entities. The *Lumut dockyard* was valued at RM 650 million in 1992 is based in Lumut, later known as the *Naval Dockyard* in 1995**.**[118] The *Naval Dockyard* possessed the capability to build and repair ships with particular expertise in the repair of weapons, electronics and electrical systems as well as design. It was able to undertake ship repair for vessels up to 6,000 dwt as well as onshore and offshore engineering, such as fabrication of modules and living quarters, jackets, platforms, pressure vessels and onshore projects, such as cement terminals, railway wagons and coaches.

The *Naval Dockyard* was reinvented yet again in 1992, becoming a private entity, *PSCNDSB.* The company has facilities at the Lumut Naval dockyard. PSC became an immense power-house in Malaysia's s maritime sector. In 1997, the government awarded a procurement contract worth RM 24 million to *PSC* in partnership with a German company, Thyssen Krupp, for an in country construction of up to 27 patrol vessels over a 10 year period. This contract was in line with the concept of national self reliance in partnership with local defence companies.[119] However, the whole project was derailed due to technical problems and delays causing *PSCNDSB* to seek another RM 1.8 billion from the government to complete the vessels.[120] In 2005, the Public Accounts Committee said that over RM 200 million ($52.6 million) was needed to meet unpaid bills and project costs incurred by *PSCNDSB* and recommended that the government rescue the project.[121] The company owed contractors, vendors and suppliers RM 80 million and an additional RM 200 million for completion of the first two vessels**.**[122] Several subcontractors and OEMs blamed the failure of the project on the overall mismanagement and lack of professionalism on the part of the *PSCNDSB* management team.[123]

PSCNDSB was also given the 'first right of refusal' to undertake all scheduled maintenance for RMN ships. This provided *PSCNDSB* control over servicing and maintenance of all Malaysian Armed Forces' ships. Other companies could only participate upon *PSCNDSB*'s refusal to undertake the work. This government policy hit the other naval companies hard, putting many of them out of business. However, due to the failure of the PV project and other internal problems, PSC was bailed out in September 2005 by a government-owned Malaysian property and palm oil plantation firm, Boustead Holdings.[124] Other naval companies recently entering the defence sector include *D'Aquarian Services, Sigma Xi and ME&O Fleet Services.* These companies mainly focus on systems integration for RMN ships.

4.8.5 Information Communications and Technology Sector

Although a late starter, Malaysia's ICT defence-related industry has caught up in the past 10 years, becoming a leading player in the local DIB. Malaysia's strong base in electronics and electrical manufacturing has laid a strong foundation for some of the ICT commercial companies to venture into defence. Some of the defence companies include Sapura Defence, Systems Consultancy Services (SCS), Ikramatik and Satang Jaya. Sapura Defence, for example, is a subsidiary of Sapura holdings, specialising in products and systems design, development, integration and manufacturing. It has built on its capabilities to design, develop, upgrade and integrate flight, land and maritime-based simulators through offsets. *Sapura* has also been successful through a joint-venture with Thales, UK, in producing military tactical hand-held VHF radios (TRC 5100 series) and accessories. SCS specialises in the C4I system and the battlefield management system. Satang Jaya, a listed company, is involved in the maintenance, repair and overhaul (MRO) of safety and survival, search and rescue equipment for the Malaysian Armed Forces, Royal Malaysian Police, Fire Fighting and Rescue Department, Civil Defence Department and Commercial Aviation and Maritime.

4.8.6 Common-User Items Sector

The defence industry also comprises a pool of local companies that specialise in producing various essential items for the Malaysian Armed Forces. Although not a high tech industry, some of these companies have now gained business in the region to supply items such as ration packs, military boots, uniforms and parachutes. Total government expenditure on uniforms and accessories, medical equipment, laundry, tailoring and footwear, as well as building maintenance, covers 98 contracts worth RM89.66 million under the 8th Malaysia Plan.[125]

Some of these companies include Glowtrade, Nadicorp, Kulitkraf, Pakaian Saling Erti and Puspamara. Glowtrade provides parachutes to the MAF and also for the export market. Pakaian Saling Erti began operations in 1984, and with a current workforce of 300 people is involved in providing uniforms and accessories to the MAF. Puspmara Sdn Bhd, established in 1980, is another company involved in the manufacture and supply of uniforms and commercial garments. Semenanjung Selatan makes combat rigid hull inflatable boats. These small and medium scale companies with low-end technology, catering to both civil and defence markets, have managed to sustain and grow their businesses.

4.9 Malaysia's Defence Industrial Subcontracting Base

Malaysia's plan has been to deepen and strengthen its defence sub-contacting base to support prime contractors.[126] Subcontracting of work from prime defence companies to small and medium scale industries has long been viewed as a way to deepen the industrial structure and create backward linkages. SMIDEC, a special semi-government agency, under the umbrella of MITI, was formed to promote the development of the SMEs in the manufacturing sector. SMIDEC provides advisory services, fiscal and financial assistance, infrastructural facilities, market access and other support programmes. SMIDEC is also responsible for the development of subcontractoring base in Malaysia through an industrial linkage programme between prime contractors and SMEs.[127] SMIDEC categorises SMEs or subcontractors into nine sub-sectors[128] For 2003 alone, SMEs contributed 26.1%

(14.2 billion RM) of value-added and 32.5 per cent (375,840) employment as a percentage of national GDP. [129] Some of the defence SMEs under the SMIDEC list include electrical and electronics products, transport equipment, machinery and equipment, metal and metal products and chemical and chemical products.

In the defence sector, the government has tried to build a subcontracting base through vendor development programmes. The major capital purchases involving such initiatives include the German Patrol Vessel project, Turkish APC 300 tanks, South African G5-Guns, the Brazilian MLRS Astros II and the Polish MBT-PT91. Eurocopter Malaysia, a subsidiary of EADS, has created work through its vendor development programme for SMEs worth RM 17.5 million.[130] Table 4.9 shows the status and growth performance of selected SMEs in the Gavin Kennedy's defence-industry related activities for the year 2003 (% share of total SMEs).[131] The government has introduced various initiatives, such as the industrial linkage programme, aimed at developing linkages between domestic SMEs, MNCs and the prime contractors. There are also efforts to try and integrate SMEs into the supply chain, thus creating local content as well as expanding international industrial clusters. However, the development of defence SMEs through backward linkages remains minimal. This topic will be examined further in Chapter 5.[132]

4.10 Role of Defence Offsets in Malaysia's Defence Industrialisation

The State has consistently introduced measures to promote Malaysia's defence industrial base. One of the most important of such policies is offsets. Offsets were introduced for the first time in 1990 by the UK when Malaysia bought the Hawk aircraft from BAE Systems. The positive result from some of the offsets projects culminating from this deal has encouraged the Malaysian government to incorporate offsets into all major defence procurement deals as a means of obtaining technology, work packages and skills enhancement through training and on-the-job experience. Offsets are seen as a way forward for industrial and technological development, particularly in the defence sector. The country's offsets initiative started around the same time as other developed and developing countries, such as the UK and South Africa, began to introduce their policies.

Malaysia has been involved in the offsets business since the early 1990s. The country views offsets as an important tool to support its import substitution policy in creating a sustainable and competitive industry. Offsets are demanded through defence procurement for various reasons, including creating a defence industry base, employment creation, dual use industrialisation, skill development and sub-contracting work.

Table 4.9 : Status and Growth Performance of SMI in terms of Output, Value-added and Employment in Malaysia's Defence-related Industries, 2003

Sector	Output (% share of SME total)	Value-added (%)	Employment (%)
Motor vehicles and Transport Equipment	2.5	3.3	2.8
Other transport equipment industry	-2.3	-0.5	1.1
Machinery and Equipment	2.9	4.2	4.1
Metal and metal products	13.6	13.9	12.9
Basic Metal Industry	16.9	19.9	3.5
Fabricated Metal product Industry	6.1	9.0	5.2

Source: Malaysia. National Productivity Corporation (NPC), *Extracted from National Productivity Corporation Industry Report,* (NPC, Kuala Lumpur, November 2005)

However, after more than 10 years of offsets implementation, questions have been raised as to the effectiveness of offsets.[133] Have offsets worked in Malaysia? It is claimed, for instance, that arms manufacturing in Malaysia has been mainly low-tech and small scale.[134] The defence industry is still in the backwater and most of the companies still require government support. The National Plan of Action Report for the Coordination and Transfer of Industrial Technology to the Ministry of Science, prepared in 1990, was not required to incorporate offsets. Various reasons have been highlighted for this ommision.[135]

OEMs argue that they are unable to transfer high tech work due to the lack of investment and skilled workers from the local companies to undertake production. The ratio of 7 research scientists per 10,000 of the labour force in Malaysia is extremely low compared to that required for a technologically sophisticated industrial programme.[136] A counter-argument is that OEMs are not genuine about releasing their technology via offsets. There is little local content in the defence equipment purchased. In line with the international product life cycle theory, only obsolete or third generation technology is passed on to the developing countries.[137] It is argued that most of the patents taken out by investors from Malaysia are in low-tech areas, such as assembly work, basic maintenance, rubber production, general cleaning, upgrade, metal fusion bonding, dispensing and optics.[138] Arguably, also the spill-over effects of offsets have not created sufficiently large backward and forward linkages in Malaysia.[139]

Generally, there has not been enough empirical work done to provide substantial evidence as to whether offsets have progressed technological and industrial development, as compared to other modes of technology transfer such as foreign direct investment. In Malaysia, there is currently little evidence to prove whether offsets are working in the way intended. The present study attempts to close the evidence gap by conducting empirical research on the effectiveness of offsets in Malaysia, particularly in the defence industry. The following chapter analyses empirical data to evaluate the effectiveness of offsets in sustaining Malaysia's defence industrial base.

4.11 Summary

This chapter has examined the reasons for defence industrialisation in developing countries, focused on the Malaysian experience. It has reflected on Malaysia's defence policy and the need to maintain self-reliant Armed Forces. Defence industrial progress is intertwined with the nation's defence procurement and

Armed Forces budgetary plans. Although the Malaysian defence industry is a late-comer, its industrial and technological development has rapidly progressed in the last 20 years. The State has been instrumental in closely monitoring and supporting the progress of the Malaysian defence industry. Government incentives and policies including the introduction of offsets have targeted the enhancement of the defence industrial base in various sectors, including aerospace, land systems, weapons and ICT. Capability development within these different sectors, however, has been mixed. The aerospace, ICT and land systems have acquired higher levels of technological capability as compared to the weapons and maritime sector. The chapter has also analysed the role of the Malaysian prime defence contractors towards creating industrial-linkages. There have been several initiatives from the suppliers and the MOD, Malaysia, to assist in developing and enhancing the sub-contracting base within the defence sector, contributing potentially towards enhancing Malaysia's defence industrial base. Finally, this chapter has provided an introduction to offsets activities in Malaysia.

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[10] Self-reliance in the Malaysian context is defined as the ability to provide the Malaysian Armed Forces independence in all aspects of defence, including spares and for maintenance and repair without relying on overseas suppliers.

[11] Common user in the Malaysian defence industry context refers to all other businesses dealing with defence and security which are not covered within the five main sectors. These include apparels, ration-packs, parachutes, uniforms and pharmaceutical products supplied to the Armed Forces and other security related agencies.

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[13] Gavin Kennedy associates defence to the market for identifiable products used in the provision of defence capability by an identifiable purchaser, the defence agency.

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[15] According to Gavin Kennedy, current expenditure include fuels, food, apparel, durables, pay and allowance, pensions, operating costs and support facilities. See Gavin Kennedy, *Defence Economics*, (Gerald Duckworth & Co Ltd, London, 1983), p.152.

[16] According to Gavin Kennedy, capital expenditure includes weapon systems, ancillary equipment, base storage facilities, communication and administrative buildings. See Gavin Kennedy, *Defence Economics*, (Gerald Duckworth & Co Ltd, London, 1983), p.152.

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[23] Herbert Wulf, *Arms Production in the Third World*, (SIPRI Yearbook, Stockholm International Peace Research Institute, Stockholm, 1985), p.330.

[24] Gavin Kennedy, *Defence Economics*, (Gerald Duckworth &Co Ltd, London, 1983), pp.134-162.

[25] R G Matthews, 'The Development of India's Defence Industrial Base', *The Journal of Strategic Studies*, 4(12), 1989, pp.405-454.

[26] Brigadier General (Rtd) Dato' Richard, Robless, Harmonizing Arms Procurement with National Socio-Economic Imperatives, *In: 97 Workshop on Defence, Kuala Lumpur, 1997,* (Ministry of Defence, Malaysia, KL, 1997.

[27] The Royal Address to Parliament, *proceedings of the D.R,V/1*,23 May 63,Col.22, 1975

[28] Chandran Jeshurun, *Malaysian Defence Policy-A Study in Parliamentary Attitudes 1963-73*, (Penerbit University Malaya, Kuala Lumpur, 1980), p.126.

[29] Also see Chandran Jeshurun, *the Growth of the Malaysian Armed Forces 1963-77: Some Foreign Press Reactions*, (Institute of South East Asian Studies, Singapore, 1975).

[30] Also see Tim Huxley, *Defending the Lion City: the Armed Forces of Singapore*, (Allen&Unwin, Australia, 2000), p.65.

[31] The armed insurgency problem ended with the signing of a peace treaty with the Communist party of Malaya in December 1989. The modernisation was mooted in the early 1980s through PERISTA (special expansion) programme but was later ceased due to the recession in the mid-1980s and resumed in 1987-1997 just before the Asian Financial Crisis.

[32] For further details, see P Sengupta, 'The MAF and Force Modernisation Challenges in the Post-Cold War Era' *Asian Defence Journal*, 4, 1998, pp.16-17, and E Dantes, 'RMN's Force Modernisation Plans', *Asian Defence Journal*, 12,1997, pp.14-21.

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[33] Dato' Sri Najib Enhances Defence Capability: Local Defence Industry Benefitting Tremendously from Recent Contracts', *Malaysian Defence Industry Council Bulletin*, 2(2001), 2001, p.3.

[34] For further details see Ang Cheng Guan, 'The South China Sea Dispute revisited?,' *Australia Journal of International Affairs*, 54(2), July 2000; ASEAN and the Securitisation of Transnational Crime in South East Asia, *The Pacific Review*, September 2003. Also see Tim Huxley, *Defending the Lion City: the Armed Forces of Singapore*, Allen&Unwin, Australia, 2000), pp.65-67.

[35] See Johan Saravanamuttu, Iconoclasm and Foreign Policy - The Mahathir Years, *In:* Bridget Welsh, Ed, *Reflections: The Mahathir Years*, Southeast Asia Studies, (Johns Hopkins University-SAIS, Washington, D.C, 2003); Joseph Liow, Personality, Exigencies and Contingencies: Determinants of Malaysia's Foreign Policy in the Mahathir Administration, *In*: Ho Khai Leong and James Chin. *Mahathir's Administration: Performance and Crisis in Governance,* (Times Books, Singapore, 2001), pp.120-160; David Camroux, *Looking East and Inwards: Internal Factors in Malaysian Foreign Policy, 1981-1994, Asia Paper, No. 72,* (Griffith University: Australia), 1994); Johan Saravanamuttu. *The Dilemma of Independence: Two Decades of Malaysia's Foreign Policy, 1957-1972,* (Universiti Sains Malaysia for School of Social Sciences, Penang, 1983); Johan Saravanamuttu, 'Malaysia's Foreign Policy in the Mahathir Period, 1981-1995: An Iconoclast Comes to Rule,'*Asian Journal of Political Science*, 4(1),1996, pp.1-16; Johan Saravanamuttu, 'ASEAN in Malaysian Foreign Policy Discourse and Practice, 1967-1977', *Asian Journal of Political Science*, 5(1), 1997, pp.35-51; Shanti Nair, *Islam in Malaysian Foreign Policy,* (Routledge, London, 1997).

[36] A document detailing defence policy was presented before the National Security Council in 1987 endorsed by Cabinet in 1990. In late 1997, a MOD publication described its organisational structure and strategy perspective. 'A Protection of its National Security'- Malaysian Ministry of Defence, *Malaysian Defence: Towards Defence Self-Reliance,*(MOD, Kuala Lumpur, 1997), p.21.

[37] ZOPFAN or Zone of Peace, Freedom or Neutrality is a treaty signed in 1968 during the height of the Cold War mainly by the South East Asian nations that wanted to stay neutral during the war. The signatories to this treaty were considered to be not participating in the Cold War and staying within the zone of Peace, Freedom and Neutrality. See Samuel Sharpe, 'An ASEAN way to Security in South East Asia?', *The Pacific Review*, 16(2), Routledge, June 2003.

[38] The FPDA was signed in 1971 between Australia, the United Kingdom, Malaysia, Singapore and New Zealand. This is Malaysia's only multilateral defence arrangement.

[39] Ministry of Defence, Malaysia (MOD), Malaysia's Defence Policy 1997, [online], MOD, Kuala Lumpur, 2006), (Accessed: 15 June 2006), Available at: http:// www.mod.gov.my.

[40] *The Military Balance*, the International Institute for Strategic Studies, (Routledge, London, 2007).

[41] For further details see Supian Ali, 'Harmonizing National Security with Economic and Technology Development in Malaysia', *SIPRI Arms Procurement Decision Making Project, Working Paper No.87*, 1997, p.30.

[42] See Stefan Markowski and Massimiliano Tani, 'Defence Expenditure, Spill-ins and threats in Asia Pacific, 1985-2001', *Defence and Security Analysis*, 21, September 2005; Paul Dunne and Sam Perlo-Freeman, 'The Demand for Military Spending in Developing Countries', *International Review of Applied Economics,* 17(1), January 2003.

[43] The government formulates a 5 year plan outlining its economic development policy and strategy for 5 years. Currently Malaysia is into its 9th Malaysia Plan effective from 2006-2010.

[44] See Dagmar-Hellman Rajanayagam, Malaysia, In: Ravinder Pal, *Arms Procurement Decision Making Volume II: Chile, Greece, Malaysia, Poland, South Africa and Taiwan*, SIPRI, (Oxford University Press, New York, 2000), pp.67-105.

[45] Abdul Razak Baginda, 'Malaysia's Armed Forces in the 1990s', *International Defence Review*, 4, 1992.

[46] Malaysian Modernisation, *Jane's Defence Weekly*, 26 November, 1997.

[47] See Sharifah Munirah, Alatas, 'Government-Military Relations and the Role of Civil Society in Arms Procurement Decision Making Processes in Malaysia, *SIPRI Arms Procurement Decision Making Project, Working Paper No.84*, 1998, p.43.

[48] EPU or the Economic Planning Unit of the Prime Minister's Department is the government's central planning agency responsible for formulating Malaysia's medium and long term economic development policies and strategies.

[49] National Development Council (NDC) is the central planning body in terms of capital outlay and functions under the Chief Secretary to the Cabinet. See also Ravinder Pal, *Arms Procurement Decision Making Volume II: Chile, Greece, Malaysia, Poland, South Africa and Taiwan,* SIPRI, (Oxford University Press, New York, 2000), pp.67-105.

[50] The Cabinet, however, does not directly intervene in procurement decisions made by the Ministry of Defence. It merely passes the annual defence budget as a whole together with whatever arms purchases that have been planned.

[51] Also see Zakaria Hj. Ahmad, Defence Industry in Malaysia, *In: 94 Conference on European Defence Industry in the Global Market: Competition or Cooperation? Chatham House, May 20-21, 1994*, (Chatham House, London, May 1994), p.3.

[52] According to a senior official from the Policy Division, Ministry of Defence, Malaysia, the draft defence policy has been reviewed by Cabinet and recommendations have been made for some amendments. He said that it is in the interests of the government to have the White Paper published as soon as possible. An interview conducted with Mr. Rajaiah Devudoo, Deputy Director, Policy Division, Ministry of Defence, Malaysia, June 2005.

[53] Zakaria, Hj. Ahmad, National University of Malaysia, 'Cautious is the Catchword in Drive for Defence Industrialization' *Jane's Defence Weekly*, 26 November 1997.

[54] For further details, see the exclusive interview with former Secretary General, Ministry of Defence, Malaysia, Tan Sri' Dato' Subhan, Jasmon, 'Malaysia Wants High-Value Long-Term Partnerships' *Asian Defence and Diplomacy*, May 2004, pp.26-27.

[55] Strategic items include defence equipment/services which impact on the operational ability of the Armed Forces such as ammunition, armoured vehicles, fighter aircraft, naval ships and like items. Non-strategic items include items such as clothing, transport vehicles, edible equipment and common-ser items. Essential items are those that comprise defence equipment services which do not directly impact on in the operational ability of the Armed Forces.

[56] Treasury letter, reference S/K.KEW/PK/PP/1100/000000/11/11(8) entitled *Garis Panduan Kontrak Jangka Panjang untuk Membangunkan Industri Pertahanan Negara,* 8 April 2004 . The Guideline takes into consideration the i. overall long term needs of the Armed Forces; ii. recent technological trends; iii. casting policy; iv. and finally current government policies. The Guideline is aimed at strategic purchases that involve high investment in terms of infrastructure, equipment/machinery, human resources and R&D efforts. The long term contract will take into consideration issues such as corporate governance, local companies, beneficiaries of offsets programme and compliance in terms of being registered with the Ministry of Finance.

[57] Dual use strategy is one where companies involved in the production of commercial items are also involved in production of defence related equipment and vice versa. This will reduce the companies' total dependence on defence business and instead concentrate on promoting dual use technology.

[58] Bilveer Singh, Defence Industrialisation and the prospects for Security Cooperation in Southeast Asia, The Multilateralisation of Pacific Asia, *In:* 94 Defence Services Asia (DSA) Conference, Kuala Lumpur, 21-22 April 1994, (DSA, Kuala Lumpur 21-22 April 1994).

[59] For further explanation of the Industrial Master Plan, see Chee Peng Lim, *Industrial Development: An Introduction to the Malaysian Industrial Master Plan,* (Pelanduk Publications, Kuala Lumpur, 1987).

[60] Edward Lawrence and Wheelwright, *Industrialisation in Malaysia,* (Melbourne University Press, Melbourne, 1965).

[61] See D Lim, *Economic Growth and Development in West Malaysia*, (Oxford University Press, Kuala Lumpur, 1973).

[62] For a thorough explanation of the Import Substitution Policy in Malaysia, see Rokiah Alwi, *Industrialisation in Malaysia: Import Substitution and Infant Industry Performance,* (Routledge, London and New York, 1996).

[63] Rokiah Alwi, Industrialisation in Malaysia: *Import Substitution and Infant Industry Performance,* Routledge, London and New York, 1996).

[64] See Nicole Ball, the Political Economy of Defence Issues and Perspectives, *In*: Andrew L Ross, Eds, *The Political Economy of Defence: Issues and Perspectives* (contributions in Military Studies), (Greenwood Press, Westport, 1991).

[65] Zainal Abidin Hj Ahmad, Malaysia's Defence Production Needs and Policy, *In*: *91 DSA Conference, Kuala Lumpur, April, 1991* (The Ministry of Defence, Malaysia) p.8.

[66] The Industrial Master Plan (IMP) formulated in 1985 maps out the path for Malaysia's industrial development. IMP proposes the type of industrial policies which Malaysia should adopt and the strategies to achieve the objectives set out. Currently, Malaysia has recently published its 3rd IMP (2006-2020).

[67] Malaysia. *Mid Term Review of the Fourth Malaysia Plan, 1981-1985,* (Government Printer, Kuala Lumpur, 1984), pp.271; also see Abdullah Mohamed, Tahir, Industrial Policy and Industrial Development: Issues and Policy Directions, *In:* Kanapathy V, *Managing Industrial Transition in Malaysia,* Ed, (Pelanduk Publication, Kuala Lumpur,1995).

[68] SDSC Conference on Implications of New Technology for Australian and Regional Security,The Malaysian Perspective, November 29-30, 1989 (Defence Industry Division, Ministry of Defence, Malaysia)

[69] See Zakaria Hj. Ahmad, Defence Industry in Malaysia, *In: 94 Conference on European Defence Industry in the Global Market: Competition or Cooperation? Chatham House, May 20-21, 1994*, (Chatham House, London, May 1994), p.5.

[70] For further discussion on the role of government in Malaysia, see Sanjaya Lall, 'Malaysia: Industrial Success and the Role of Government', *Journal of International Development,* 7, 2001, pp.759-73.

[71] The offsets unit was re-structured in the year 2003 to create two additional open posts to incorporate one military appointment as well as one from the other services, such as university, researchers or the Police Force. Prior to this, offsets management was handled by a Principal Assistant Secretary and was assisted by an Assistant Secretary and clerical staff. The military and other services were incorporated to bring in technical expertise mainly to handle offsets negotiations.

[72] The Defence Industry Division's functions include: promoting the development of local defence manufacturing and maintenance capabilities; implementation of defence privatisation policy and projects; implementation of offsets programmes and transfer of technology activities; monitoring of companies under the supervision of MOD and also secretariat support to the international defence exhibition.

[73] See Ministry of Defence, Malaysia (MOD), Malaysian Defence Industry Council, [online], (MOD, Kuala Lumpur, 2006), (Accessed: 24 September 2006),
Available at http://nwww.mdic.mod.gov.my for further details on the formation, functions and members of the Malaysian Defence Industry Council.

[74] Although the council was formed in 1990, it did not really take-off until 1997. A few of the MDIC members re-started the MDIC initiatives. The Defence Industry Division, as the secretariat to the MDIC, has been tasked to review the composition of members as well as the fundamental objectives of this council.

[75] The initiatives of the MDIC include the Malaysian Defence Industry Bulletin which focuses on defence industry development in Malaysia, the Defence Industry Directory, published in 2005 and the defence industry inward and outward trade mission.

[76] Interview with Mr. Zubir Zakaria, Principal Assistant Secretary, Defence Industry Division, Ministry of Defence, Malaysia, 20 May 2006; Also see 'Long-dormant MDIC is brought back to life', *Jane's Defence Weekly*, November 26 1997.

[77] STRIDE, Fieldwork survey in Malaysia, 30 April-31 July 2005.

[78]DSTC was formed in 1968 to provide scientific and technological advice to the MOD and MAF in meeting capability requirements as well as to carry out R&D in promoting local defence production. Its name was changed to STRIDE in 2003 and the facilities were moved to Kajang. STRIDE had around 500 scientists and engineers working for the organisation in 2007.

[79] Interview with Dr. Ghafar Ramli, Director of STRIDE, MOD, and Malaysia, 15 June 2005.

[80] IRPA provides special incentives of 100% tax exemptions for firms investing in high technology operations.

[81] MIGHT was formed mainly to assist the nation towards attaining and sustaining competitiveness in the high technology sectors.

[82] Lt Col, Kamarulzaman Zainal, Technology Depository Agency (TDA), *In: 05 Workshop on Making Offsets Works*, Menara Kuala Lumpur, 7 July 2005, (Ministry of Defence, Malaysia and Cranfield University, United Kingdom, Kuala Lumpur, 2005).

[83] Malaysia, Malaysian Industry Group for High Technology, (MIGHT), *Malaysian Aerospace Council Report*, (Ministry of Science, Technology and Environment (MOSTE), Putra Jaya, November 2005).

[84] The National Aerospace Blueprint was formulated in 1996 with MIGHT providing the secretariat. The Blueprint recommends the establishment of a national level steering committee to oversee the development of the aerospace industry.

[85] The key ministries involved in overseeing offsets have officials represented at the MDIC. Most issues tabled at the meetings are brought to the attention of the respective ministries if they fall within the jurisdiction of any of the agencies concerned.

[86] The Local content Policy is contained in Treasury Circular WT/TPR/S/31 dated 3 November 1997. However, this circular is not brought to the attention of foreign suppliers most of the time or are blurred by technical issues disqualifying local participation on many occasions.

[87] 'Meeting on Industry Blueprint Action Plan', *Malaysian Defence Industry Council (MDIC) Bulletin*, December 2005, p.10.

[88] 'How SME has grown from Small Beginnings' *Jane's Defence Weekly*, November 26 1997.

[89] Information extracted from author's participation at the *Defence Industry Blueprint Workshop* organized by the Ministry of Defence, Malaysia, held in Regency Hotel, Port Dickson, 22-24 June, 2005. The three day workshop was attended by representatives from relevant government agencies, Malaysian Armed Forces and defence industry companies from the Malaysian Defence Industry Council Working Groups.

[90] Malaysia, Ministry of Defence, *Defence Industry Blue-Print Report*, (Ministry of Defence, Kuala Lumpur, 2002); *Defence Industry Blueprint Workshop*, Regency Hotel, Port Dickson, Ministry of Defence, 10-12 October 2002.

[91] Information obtained from Procurement Division, Ministry of Defence, Malaysia, 2006.

[92] This table has been modified from the original table prepared by PRIMA Consulting Services, a consultant under the MIGHT group as part of the Defence Industry Blueprint. PRIMA was appointed to draw up the draft Malaysian Defence Industry Blue Print. The table is cited with the permission of the Ministry of Defence, Malaysia although the blueprint is still in the form of a draft.

[93] Ministry of Defence, Malaysia (MOD), *Malaysian Defence Industry Council*, [online], (MOD, Kuala Lumpur, 2006), (Accessed: 31 August 2005), Available at: http:// www.mdic.gov.my.

[94] The MDIC, however, allows even organisations without proper defence infrastructure to be admitted as members as it sees value creation and the advantages gained by these smaller companies by being part of the MDIC.

[95] 'SME Aerospace Spearheading Aerospace manufacturing in Malaysia', *Malaysian Defence Industry Bulletin*, December 2001, p.23; 'CTRM Enhances Malaysian Aerospace Industry', *Malaysian Defence Industry Bulletin*, December 2001, pp.24-25.

[96] Excelnet is located in the 'intelligent city' of Cyberjaya within the Multimedia Super Corridor.

[97] First tier companies are aircraft manufacturers (primes); 2nd tier are manufacturers of major aircraft systems and substructures and 3rd tier are suppliers of parts, components and specialised services.

[98] Telephone interview conducted with CEO of SMEA, Colonel Chee Ng Boon, February 2006.

[99] Telephone interview conducted with CEO of SMEA, Colonel Chee Ng Boon, February 2006.

[100] Malaysia. Malaysian Industry-Government for High Technology (MIGHT), *A Study on Parts and Components Manufacturing in the Malaysian Aerospace Industry,* (Prime Minister's Department, September 2003) for further details.

[101] Ibid.

[102] Andres Leslie and Wong Dennis, 'Airbus Deals a Boost for Aerospace Plans', *New Straits Times,* 9 December 2005, p.15.

[103] During an interview with Colonel (Rtd) Chee Eng Boon, a senior aerospace engineer who was involved in the project, it was mentioned that the project had to close due to increasing costs and lack of export markets for the product. Malaysia, however, did produce a few of the aircraft for the Indonesian Armed Forces as part of a countertrade deal during the purchase of the CN 235, February 2006.

[104] NADI was established in 1983 mainly for aerospace-related industry. In 2004, the NADI Group was restructured to comprise maintenance, repair and precision engineering. The companies are Airod, Scandinavian Avionics (M) Sdn Bhd, Aerospace Corporation (ATSC) and SME Aviation Services Sdn Bhd, Aerospace Corporation (ATSC), SME Aerospace and SME Ordnance.

[105] Airod which occupies 77.4 acre located at the Sultan Abdul Aziz Shah(SAAS) Airport has facilities that include a wide body hangar (78m by 170m) capable of accommodating eight c-130s at any one time; six maintenance and modification hangars; a paint and strip hangar with a modern environment and three test cells (jet, prop and industrial turbine engines).

[106] AIROD, *Company Profile*, [online], (Airod, Kuala Lumpur, 2006), (Accessed: 20 June 2006), Available at: http:// www.airod.com.my.

[107] ATSC is divided into three divisions: Combat Aircraft Division(CAD) located at ATSC's Aircraft Maintenance Centre on the Eastern coast of Peninsular Malaysia, currently performing depot level maintenance and repair of RMAF MIG 29 aircraft; Aviation Support Division(ASD) located at the Terminal 3,Subang to provide second and third line maintenance, overhaul airfield specialist vehicles and aerospace support, Materials and Product support Divisions providing equipment support for the MIG-29 fleet.

[108] Eurocopter Malaysia was part of an offsets programme under the purchase of the 6 FENNEC helicopters from EADS, France, in 2001, for the Royal Malaysian Navy. Eurocopter, which is wholly- owned by EADS was formed in 2003. Eurocopter acts as a regional service centre for all Eceruil/Eurocopter planes.

[109] For a more critical discussion on the development of Malaysia's aerospace industry, see Tunku Izham, *The Future of the Malaysian Aerospace Industry*, MDA Dissertation, No.10, (Cranfield University, UK Defence Academy, December 1996).

[110] Bilveer Singh, Defence Industrialisation and the prospects for Security Cooperation in Southeast Asia, The Multilateralisation of Pacific Asia, *In: 94 Defence Services Asia (DSA) Conference, Kuala Lumpur, 21-22 April 1994,* (DSA, Kuala Lumpur, 1994), p.16.

[111] On Dec 7, 1993, the Standards and Industrial Research Institute of Malaysia (SIRIM) certified and registered SMEO's quality system in compliance with the MS ISO 9002:1991 Quality System.

[112] Malaysia decided to venture into heavy industries, especially the automobile industry, as part of its ISI Strategy.

[113] DRB HICOM, the holding group is the producer of Malaysia's National Car, Proton.

[114] Malaysian Mining Corporation's (MMC) main activities include civil construction, power engineering, gas and pipeline engineering, metal fabrication engineering, design and consultancy services, transport engineering and turnkey projects.

[115] Interview with Colonel (Rtd) Ahda, MMC Defence, June 2005.

[116] Interview with Colonel (Rtd) Ahda, MMC Defence, 20 June 2005. Telephone interview with Colonel (Rtd) Andrew, MMC Defence, 15 August 2005.

[117] Interview with Colonel (Rtd) Narinder Singh , Shah Alam, DEFTECH, May 2005.

[118] Bilveer Singh, Defence Industrialisation and the prospects for Security Cooperation in Southeast Asia, The Multilateralisation of Pacific Asia, *In:94 Defence Services Asia (DSA) Conference, Kuala Lumpur, 21-22 April 1994*, (DSA, Kuala Lumpur, 1994), p.18.

[119] 'Malaysia's Boustead Buys Stake in PSC-Naval Dockyard', *DefenceNews.com*, 9 May 2005.

[120] **'**PM Abdullah promises to sort out Malaysian Navy Deal', *DefenceNews.com*, 18 August 2005, pp.2-4.

[121] Ibid, p.3.

[122] Ibid, p.3-4.

[123] Interview with a local subcontractor involved in the project. 15 May 2005.

[124]Some 70% of the shares are owned by the Armed Forces Pension Fund *(Lembaga Tabung Angkatan Tentera)*. The 30% stake is worth RM 166 .5 million or $44.16 million in 2005.

[125] Information obtained from Procurement Division, Ministry of Defence, Malaysia, September 2006.

[126] For a discussion on subcontracting in Malaysia, see Wong, Poh Kam, *Technological Development through Subcontracting Linkages,* (Asian Productivity Organisation, Tokyo, 1991).

[127] Malaysian Small and Medium Development Corporation, *Industry Profile*, [online], (SMIDEC, Kuala Lumpur, 2006), (Accessed: 23 September 2006), Avialable At: http://www.smidec.gov.my.

[128] The sectors are food and beverages, electrical and electronics, transport equipment, machinery and equipment, textiles and apparels, metal and metal products, wood and wood-based products, chemical and chemical products and rubber and plastic products.

[129] Malaysia. Malaysian Small and Medium Development Corporation, *National Production Corporation-SMIDEC Report*, (Ministry of International Trade and Industry, Kuala Lumpur, 2005).
.
[130] Interview with Mr. Philippe Lubrano, CEO of Eurocopter Malaysia, Subang, June, 2006.

[131]The figure shown is a percentage of total output manufactured, total value added and total employment of SMEs in Malaysia.

[132] For a general discussion on the problems faced small and medium industries in Malaysia, see Ismail Muhamad Salleh, *Small and Medium Scale Industrialisation: Problems and Perspectives*, (ISIS, Kuala Lumpur, 1996),

[133] Issues pertaining to the impact of offsets on the Malaysian economy have been raised at high level meetings such as Cabinet meetings, MDIC meetings and at Defence Offsets Committee Meetings chaired by the Ministry of Defence.

[134] See Richard A Bitzinger, Offsets and Defence Industrialisation in Indonesia and Singapore, *In:* Jurgen Brauer and J Paul Dunne, *Arms Trade and Economic Development: Theory, Policy, Cases in Arms Trade Offsets,* (Routledge, London, 2004), p.255.

[135] The report is entitled 'Industrial Technology Development: Technology and the Environment'. See Sunil Mani, *Government, Innovation and Technology Policy,* (Edwar Elgar Publishing Limited, Cheltenham, 2002), p.152.

[136] Ibid, p.153.

[137] Raymond Vernon, *Sovereignty at Bay: The Multinational Spread of US Enterprise,* (C Nicholls and Co.Ltd, USA, 1971).

[138]United States Department of Commerce, *United States Patent and Trade Mark Office,* [online], (USTPO, Washington, D.C, 2006), (Accessed: 12 April 2006), Available at: http://www.uspto.gov.

[139] Sunil Mani, *Government, Innovation and Technology Policy*, (Edwar Elgar Publishing Limited, Cheltenham, 2002).

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Chapter 5

5. MALAYSIA: DO OFFSETS WORK?

5.1 Introduction

This chapter discusses the growing importance of offsets within the defence market, requiring buyers and sellers within the arms trade to include offsets in almost all major capital sales. Contrary to its soaring popularity, and the frequent *hype* about offsets success stories, questions still arise as to the impact and benefits of offsets as an effective tool for technological and industrial development.

This study examines the effectiveness of offsets as a tool for technological and industrial development, particularly for sustaining Malaysia's defence industrial base. Referring to the study framework in Chapter 1, within developing countries, offsets are viewed as a catalyst for *take-off* through technology acquisition, creation of value-added activities, skills enhancement and the promotion of supply chain networks and exports. In the defence sector, offsets are employed particularly to acquire capabilities within the defence industry to support self-reliant Armed Forces. Offsets in developing countries involve selective government intervention to ensure structural changes in the identified technological and industrial sectors. Intervention may be via the selection of technology/projects, or skills to be acquired, or the choice of recipients. Therefore, the offsets contribution towards creating a sustainable defence industrial base in developing countries depends on the formulation, process and implementation of a pragmatic and realistic offsets policy.

Malaysia's offsets objective is two pronged: firstly, the development of high technology sectors, mainly aerospace, and, secondly, the strengthening of the defence industrial base. The government is largely instrumental in ensuring that offsets are geared towards achieving these two objectives. This chapter evaluates whether offsets credits have been effectively utilised in the development of Malaysia's defence industrial base. There is also a need to explore how Malaysia's offsets objectives and strategy were formulated.

What has been the role of the government towards building a sustainable defence industrial base? What value has Malaysia obtained through offsets, such as those direct and indirect, and via the type and category of technology? How have offsets impacted on Malaysia's defence industrial base? What have been the challenges faced in the effective utilisation of offsets? The research data obtained through the study questionnaire, semi-structured and open-ended interviews will be used to answer these questions and, in particular, how offsets have been utilised for the development of a sustainable Malaysian defence industry. The triangulation methodological method approach adopted in this research helped verify data gathered via both quantitative and qualitative techniques. Data collecting tools included survey such as questionnaire, semi-structured interviews, open-ended interviews, archival sources such as government reports, procurement contracts and company financial reports as well as participatory observation. The evidences were analysed and the outcomes were verified through cross- checking of information in order to to ensure validity and at the same time eliminate biasness. Author's previous position of being directly involved in offsets management at the Defence Industry Division, MINDEF validated the participatory observation research technique especially in discussing issues related to policy and implementation of offsets in the Malaysian context.

Section two of this chapter evaluates the study findings on Malaysia's offsets policy, process and implementation. This offers a thorough discussion of the offsets objectives, policy formulation and strategy within the overall defence procurement stage. The section on implementation includes findings on the planning of offsets programmes, the negotiation process and the contractual terms and monitoring mechanisms. There is also an evaluation of Malaysia's scope of offsets in relation to the total number of projects, their value as well as the categories of offsets recipients. Section three critically evaluates the role of government in sustaining Malaysia's defence industrial base. This section explores the initiatives undertaken by the government towards promoting defence industrialisation as well as the challenges faced in trying to achieve an effective offsets outcome.

Section four focuses on offsets projects in Malaysia, undertaking analysis in terms of the impact of technology transfer through offsets on the technological absorption capability of local firms. This includes analysis of the selection and evaluation of technology by recipient firms, firm strategy towards training and the process of technology development leading to R&D and the commercialisation of technology within the defence sector. The section also addresses technological collaboration and technology sharing-problems with sellers and the government in the technology absorption process. Section five measures the benefits of offsets in Malaysia. This section evaluates the benefits of offsets in relation to employment creation' enhancement of skills' promotion of a competitive supply chain, technological spin-offs, dual-use industrialisation, diversification and the fostering of exports and marketing assistance. Section six analyses the transformational costs of offsets. Various issues are explored, including whether offsets involve additional costs to the buyer country and transparency within offsets practice. This section also discusses the challenges faced by the Malaysian defence industry in attaining a sustainable and competitive defence industry contributing towards indigenisation and self-reliance.

5.2 Malaysia's Offsets Policy

5.2.1 Setting Malaysia's Offsets Objectives

Chapter 2 concerned itself with examining the importance of industrialisation for developing countries and how technology acquisition can alleviate a nation's backwardness. In this respect, Malaysia's Vision 2020 policy has been aimed at re-aligning its industrial focus from labour-intensive technology-based industries to capital and knowledge based industries. Malaysia has positioned itself within South-East Asia to develop high-technology sectors, particularly in defence and aerospace. Offsets have mainly been used as a platform to attract high technology capital- and service-based technology industries for achieving this purpose. The Fourth Prime Minister of Malaysia, Dr. Mahathir Mohammed, during an opening speech at the sixth LIMA show (1981-2004) in Langkawi stressed the importance of offsets when he mentioned:

The supplier offering the most attractive offset programmes, in terms of value and depth of technology, with sustainable business opportunities, will command substantial weightage. [1]

Similar issues regarding offsets were mentioned by the Minister of Defence, Dato' Najib Tun Razak, during various speeches on defence industrialisation and at the MDIC platform, pleading for both OEMs and local companies to use offsets for sustainable collaborative technology development.

Offsets in Malaysia are used to enhance the defence industrial base. The short-term strategy aims at creating more self-sufficient Armed Forces in terms of through-life support, including maintenance, repair and over-haul (MRO), logistic support and spares management. The government seeks to ensure that its Armed Forces are in a combat ready position in the short-term through in-country industry support instead of having to rely on overseas suppliers. In the longer-term, however, the objective is to equip the defence industry to undertake defence-related work in manufacturing, assembly, maintenance, integration and support.

Offsets are also seen as a political tool to justify military purchases. There is generally a lack of public awareness and scrutiny in relation to Malaysia's defence budget and spending. However, international development in matters of defence and security has increased public awareness on issues related to defence spending in Malaysia. The government has become more sensitive to the public voice and the need to justify military purchases and defence spending in parliamentary debates. Therefore, when offsets were first introduced to Malaysia, there was a general feeling that the spin-offs from this tool in terms of employment, technology and exports could be used to justify military purchases.

A further aim of the offsets policy is to complement national development policies, such as the New Economic Policy, Industrial Master Plan, the Five-Year-Plan and Science and Technology Policy. The government's 1990's approach was to encourage the participation of Malay entrepreneurs in high technology sectors. Offsets were capitalised to further enhance this objective by ensuring participation of local people in high technology sectors, such as aerospace and defence; the aim being to create employment, skills enhancement and technology development capability within the *bumiputera* firms. Offsets were seen as an effective means towards achieving this goal.

In relation to human resource development and skills enhancement, a key objective of the nation's offsets policy has been the training of labour in high technology sectors related to defence and aerospace. Rapid changes due to globalisation have created the demand for competitive skilled people.[2] Malaysia's Multimedia Super Corridor, for example, is focused on the development of a knowledge economy with information technology as its base. The Ministry of Human Resources, in particular, has placed great emphasis on training and human resource development in Malaysia. This is reflected in the fact that 20.6%, or RM22.66 billion, of the total development allocation for the 8th Malaysia Plan period (2001-2005) has been set aside for education and training programmes.[3]

5.3 Offsets Policy Formulation

Malaysia's countertrade operations commenced during the economic recession of the early 1980s. Countertrade, particularly, barter and counterpurchase, were seen as a viable vehicle for entering into international trade.[4] The Countertrade Department at that time was under the supervision of the Ministry of International Trade and Industry (MITI). However, as economic conditions improved in the early 1990s, barter and counterpurchase types of activities were substantially reduced and eventually the countertrade policy was sidelined. Responsibilities for such activities were shifted to the Ministry of Finance (MOF). Offsets only became popular in the 1990s when Malaysia bought its first set of Hawk aircraft from BAE Systems.

Initially, offsets management was undertaken on an *ad-hoc* basis, with offsets projects identified and determined by the government on a case-by-case basis. There were minimal guidelines and directions for project choice that could prove 'additionality' or 'causality'. The quality and content of the offsets projects depended mainly on the skills and knowledge of individual project teams. MITI had issued a countertrade policy, mainly consisting of the terms and conditions for counterpurchase deals. This document, however, became less popular as the demand for counterpurchase and barter-type activities within the country diminished. No formal policy or guidelines on offsets existed except for a brief document published in October 1999 by MOF **(Appendix P).** This document provided details, such as minimum threshold and offsets objectives, definitions and various types of offsets to be pursued. A committee existed within MOF to manage offsets programmes.[5] Yet, many of the activities leveraged had minimal emphasis on treating offsets as a component of Malaysia's technological and industrial development.

Nevertheless, the huge defence capital purchases under the Eight Malaysia Plan (2001-2005) forced the government to reconsider the offsets management process. Lack of structured offsets guidelines and knowledge amongst MINDEF civil service personnel on offset matters made negotiations and the finalisation of proposals difficult. [6] The question of whether Malaysia was getting value for money and thus enhancing its defence industrial base obliged the government to introduce several important measures, as follows:

i. Appointment of MIGHT[7] in the year 2000 to evaluate the effectiveness of offsets.[8] MIGHT was mandated with resources and provided access to government documents and industry to obtain evidence to measure the impact of offsets programmes in enhancing industrial competitiveness in Malaysia's defence sector and to propose recommendations on how to utilise offsets effectively.[9]
ii. Exposure of Malaysian officers to offsets management training in South Africa and the United Kingdom and via a series of in-country workshops creating awareness and understanding of offsets within the Malaysian defence community.[10]
iii. Invitation for consultants to study the Malaysian defence economy to suggest improvements and recommendations for the formulation of an offset policy.

A 2003 Cabinet decision that MITI should review Malaysia's countertrade policy in view of contract values being inflated by as much as 5% due to the inclusion of countertrade agreements in government procurement.[11] MITI referred to MIGHT's study conclusion that offsets benefits are limited, due to the:

i. Absence of coordinated and comprehensive offsets planning prior to the purchase of equipment.
ii. Weakness of management in terms of financial and manpower planning as well as technology transfer.
iii. Lack of local absorptive capacity of foreign technologies and OEM support in the export of goods by local companies.[12]

Based on MIGHT's findings, MITI recommended that countertrade be de-emphasised in government procurement. This was because countertrade arrangements inflate the cost of purchase and arguably do little to raise local capability in technology development. The government decided not to totally scrap offsets but to seriously review the policy and process by adopting a more structured offsets practice with the view to increasing the effectiveness of offsets. A committee chaired by the Economic Planning Unit (EPU) was formed to review Malaysia's offsets process and formulate a written offsets policy. MINDEF, as the largest beneficiary of offsets, undertook the task of formulating a draft offsets policy, tailored solely to defence procurement requirements. This draft was then tabled at a high level meeting chaired by the EPU.[13] The draft policy completed in 2003, after much deliberation, was finally approved by MOF in 2005 for implementation by MINDEF.[14] However, the new and current policy was solely geared to defence offsets and did not apply across the board to all other ministries.[15] While offsets were widely practised by other ministries, there was less initiative on their part to comply with formal guidelines. However, there were on-going pressures to broaden the scope of the defence offsets policy in order to make it a national offsets policy. [16]

The 2005 emerging national offsets guidelines bear numerous similarities with the earlier fragmented offsets guidelines. Besides an explicit call for strategic partnerships and the focus on high-value added activities, the new policy offered little in the way of additional initiatives. Nevertheless the defence offsets guidelines offer clarity of purpose, specifying aims to enhance international competitiveness through enhancement of economic and technological capabilities. The explicit objectives of the policy include: the fostering of strategic international partnerships, contributing to the economic and industrial enhancement of local expertise, capacity and marketing potential; maximum usage of local content; establishment of a sustainable defence industrial base, including strong logistic support capabilities; promotion of inward technology transfer; collaboration in research and development projects; and cooperation in local human resource development initiatives, contributing to the generation of a high-value Malaysian skill-base.

Malaysia's offsets policy outlines reflect all the usual generic features of the offset process, such as monitoring of credits, the timescales for completion, as well as tendering requirements. However, more interestingly, Malaysia's specific-guidelines require that:

i. Additional weightage be given to direct offsets compared to indirect offset.
ii. Exceptionally, multipliers credits should apply, influenced by the extent to which Malaysian companies, universities and R&D-based organisations are able to exploit intellectual property rights derived from joint projects.
iii. A procurement threshold of Euro 10 million is required to activate offsets requirements.
iv. A 100% countertrade target against total contract value be set, subject to a minimum of 50% of contract value. This can be split between counterpurchase and offsets with offsets forming at least 50% of countertrade value and is subject to review on a case by case basis.
v. A compensation requirement of 5% of the contract value be paid to the Malaysian government at contract start, representing liquidated damages for any unfulfilled countertrade /offset obligations.[17]

The policy in general takes into consideration various uncoordinated national policies incorporating and cross-linking their key elements into a coherent 'holistic' set of guidelines. A MIGHT Report indicates that 51% of defence respondents surveyed believe that the offsets programmes are in line with Malaysia's macro-strategy.[18] Malaysia's new offsets policy model is integrated into Malaysia's Vision 2020, the

Five-Year Policy, Industrial Master Plan, National Development Policy (NDP) and the Science and Technology Policy to ensure that defence industrialisation is calibrated into the country's overall industrial and technological strategy. The policy still lacks focus, however, and has obvious faults due to the non-publication of critical documents, such as those relating to defence policy, defence industry policy and strategy and defence technology policy. Further, the lack of emphasis on the defence industry is reflected by the fact that this sector does not feature as a separate category within the Industrial Master Plan (IMP 3).[19] There has also been a lack of consultation with local industry as a principal stakeholder in the formulation of the policy.[20] The offsets policy lacks clarity in risk assessment and associated metrics determining project 'sustainability'. Moreover, there is an absence of multipliers and pre-offsets credits to attract foreign investors to Malaysia, bringing high value-added projects without the additional costs incurred by offsets. [21]

5.4 Offsets Management Process

5.4.1 Planning

The relevance of introducing an all-embracing process involving adequate planning, implementation and monitoring to ensure the effectiveness of offsets programmes was examined in Chapter 3. In Malaysia, at the initial stages, offsets were an after-thought and not included as part of the initial procurement tender requirement. In most instances, suppliers were notified of such an intention 'after' the bid had been submitted. However, this practice has created difficulties for both offshore suppliers and the Malaysian defence industry. Suppliers, not being forewarned of offsets requirements have failed to factor in the time and costs of offsets activities in procurement. Malaysian companies, in turn, have not been awarded sufficient time to plan and cater for offsets work. The offsets authority appointed to coordinate and negotiate these deals have often been left with insufficient time to discuss and finalise a concrete offsets package.[22] Moreover, offsets projects continue to be negotiated after the final contract has been signed, losing the leverage to obtain the best possible offsets packages.

When the offsets implementation function was transferred to MINDEF in 2001, there was an initiative to seriously study the procurement process flow. The procurement flow-charts as per **Appendix N** show that offsets have not featured in the initial stages of procurement planning. Further, the absence of an offsets project team shows that procurement decisions are mainly based on pricing and technical issues as opposed to the quality of the offsets package.[23] The chart contradicts the notion that offsets have been influential in Malaysia's procurement decisionmaking. Several documents including the MIGHT Report pointed to the lack of planning in relation to offsets at the procurement stage. This included last-minute inclusion of local content and industrial participation into tender bids. As most of Malaysia's procurement deals are on a government-to-government basis, the offsets recipients often end-up with less if the offsets deals are not concluded before the main contract is agreed. Last minute inclusion of offsets leaves insufficient time for offsets authority, industry/recipients and suppliers to plan and work-out effective offsets projects.[24] This also amounts to a lack of planning in the selection of technology and the inability of OEMs and the government to carry out auditing of the identified technology recipient companies. Local companies request that preliminary planning and discussions be held with end-users and OEMs before procurement decisions are made. Local firms want to be involved along-side end-users in determining industrial participation via local content.[25]

Table 5.1 shows the response to this study's 2006 offsets survey in relation to offsets recipients' preparedness to participate in offsets programmes. The results show that 88% of the firms are not adequately prepared to undertake offsets projects due to insufficient notification regarding potential projects. Also, 88% of the respondents claim to be unprepared with respect to investment, infrastructure and human resources, because their late inclusion as a technology partner.

Table 5.1: Offsets Recipient Preparedness to Participate in Offsets Projects

Question 6.01	Yes (%)	No (%)
Does your company have adequate resources to undertake the offsets programme in terms of : • infrastructure , plant and machinery • financial resources • skilled workers • commitment(marketing, R&D, training)	12%	88%
Adequate Planning before embarking on projects	12%	88%

Source: Malaysia Survey of Offsets Recipient Firms (July 2005)

In 2003, the MOD response to the MIGHT Report and consultant recommendations was to restructure its procurement process and tender documents by including offsets as part of the tender-bid. This was intended to provide sufficient notice to the suppliers of the MOD's requirements re offsets. The processes were altered to incorporate offsets into MOD's procurement process.

As shown in Figure 5.1, below, there are two types of offsets workflows. The workflows differ between procurement on a government-to-government deal (direct negotiation) and procurement via competitive tendering (open/restricted tender). For direct negotiations, suppliers are identified before-hand, based on political considerations. The offsets proposal is submitted together with a tender document. The proposal will be evaluated and feedback provided by the DID to the supplier concerned, after consultation with various users and local industries. The supplier may need to revise the proposal, based on feedback until both the DID and supplier's offsets teams come to an agreement on the details of the offsets package. The final proposal, subject to agreement from all relevant parties, will be forwarded to the CTC. Upon approval from the CTC, the proposal will be forwarded to the Procurement Division[26] to be incorporated into the main defence contract. The Procurement Division, responsible for the parent contract, will forward the main contract together with the offsets clause to the MOF for approval. Once the contract comes into effect after signature between the buyer and seller, the DID will take over all offsets implementation activities.

In the case of a restricted or open tender, where there may be competitive tendering based on more than one potential supplier, as shown in Figure 5.2, the initial processes are similar except that there will be an invitation to tender. The various suppliers' offsets proposals will be separately evaluated based on projects, value-added activities, spin-offs to the buyer nations and any additional costs incurred due to offsets. The different proposals are evaluated and discussed by the DID, with consultation from relevant authorities. Subsequently, DID will recommend the best offsets package to the Tender Board. The Board will eventually consider purchase, based on price, technicality and offsets.

The current process provides suppliers with sufficient information ahead of time regarding offsets requirements. It also provides the suppliers with opportunities to do substantial groundwork in sourcing for good quality offsets projects and suitable local industry partners.[27] The offsets authority has additional time to plan and coordinate new projects. Currently, 90% of procurement involving offsets are based on direct negotiations.

The current process nevertheless lacks several crucial features including the:

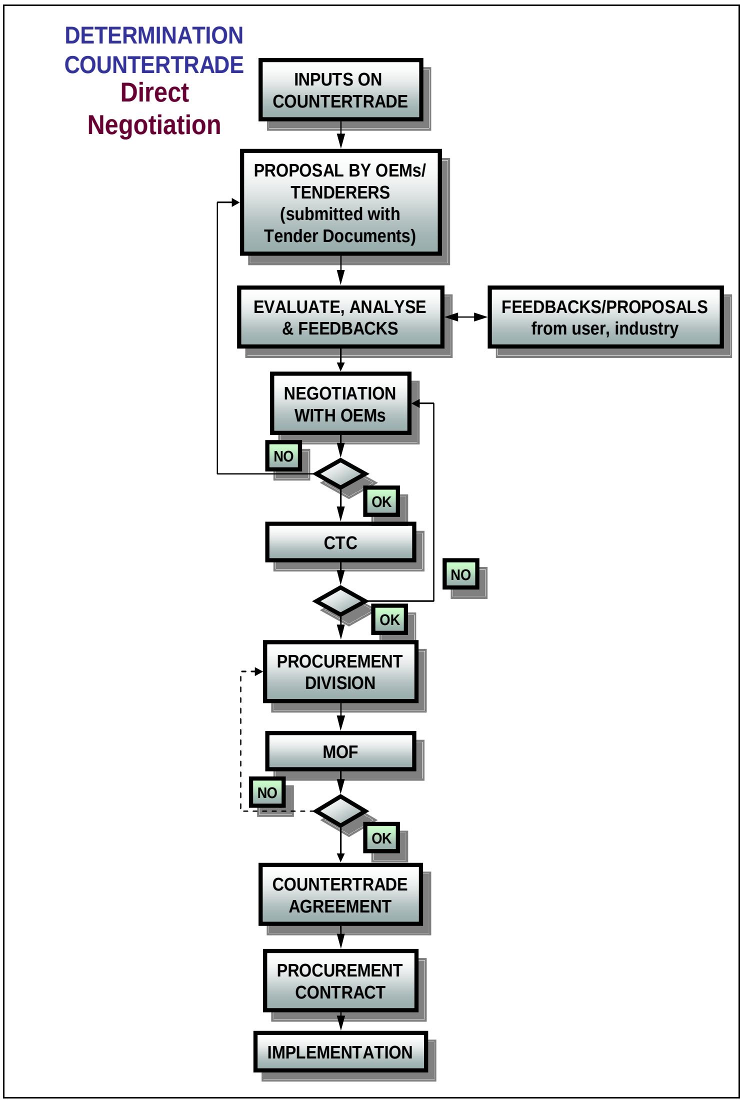
i. Lack of information flows from the project team in terms of local content requirements and the extent of local participation for technology absorption.
ii. Lack of coordination between the parties involved in the procurement process, including the technical project team, pricing project team and the DID to determine the scope of the offsets projects.[28]
iii. Lack of communication and fact-finding to gauge local industry capability to undertake offsets projects.
iv. Absence of an offsets project team as part of the main procurement contract.

v. Lack of clarity as to whether offsets plays a vital role in procurement decision making and the weight given to offsets as compared to other components in procurement decisionmaking.

vi. Absence of a countertrade committee to evaluate and approve offsets projects.[29]

Even though the offsets process is clearly laid out, in practice it is still very fluid.

Figure 5.1: Determination of Countertrade: Direct Negotiations



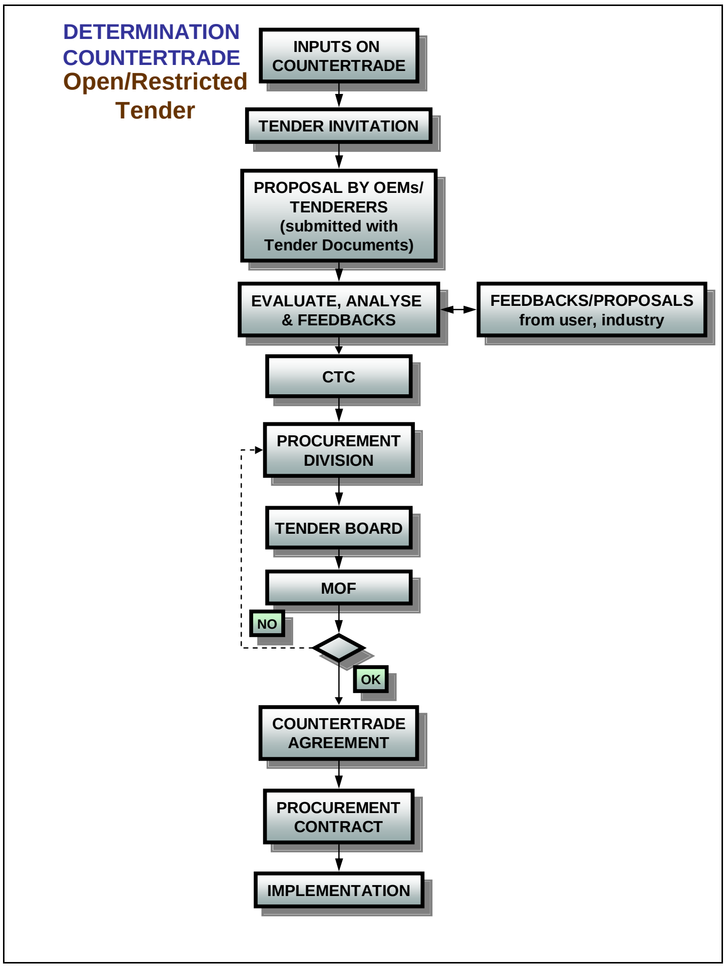
Source: Defence Industry Division, 25 June 2005, Ministry of Defence, Malaysia

5.4.2 Offsets Negotiation

The need for both suppliers and buyers to be adequately informed of the technicalities of offsets was discussed in Chapter 3. The complex and diverse nature of offsets requires a high level of efficiency and sufficient knowledge of the subject amongst bureaucrats handling the subject. The learning curve is steep and any lack of understanding on the subject will be detrimental towards the buyer country obtaining the best deal from suppliers.

Within Malaysia's MOD, offsets are handled by a special unit called the Offsets Unit of the DID. The unit's three man team, consisting of two military and one civilian officer, are responsible for offsets management including evaluating proposals, negotiating, coordinating and implementing offsets projects. The nature of the appointment of these officers requires them to move every few years, leaving a high degree of attrition amongst officers dealing with offsets management within the Department. Further, officers handling offsets within the MOF and the MOD lack the exposure and experience in the broad offsets field. The absence of continuous learning on offsets management in-country and the high cost of training overseas has hindered MOD from exposing its officers to recent developments in the offsets sphere.[30] Successful negotiations require officers to be skilful in understanding the tools and contractual terminologies of offsets.

Figure 5.2: Determination of Countertrade: Open/Restricted Tender



Source: Defence industry Division, 25 June 2005, Ministry of Defence, Malaysia

5.4.3 Offsets Contractual Terms

The effectiveness of offsets depends very much on the contents of the offsets contract, such as provisions for the type of technology transfer, the cost of technology, remedies for non-compliance and future business. In Malaysia, as the offsets contract is part of the main contract, most offsets contracts are standardised as per offsets values, proportion of direct and indirect offsets, objectives, details of the offsets projects, nominated recipients, implementation schedules, monitoring mechanisms and penalty clauses for non-compliance.

Malaysian contracts are kept flexible and in most instances the final offset recipients are not determined until after the contract has been signed. Contracts do not restrict the inclusion of local or regional resources, such as machines and manpower. The contracts also spell out details of the technology being transferred, such as design, R&D, management and technical know-how; they also include provisions for educational courses, training services, specialised technical services, transfer of technical instructions and manuals. Objectively, these contracts do not restrict local or outside sourcing of material, machines and equipment; the suppliers are flexible as to where and how the contents are sourced.[31] Table 5.2 indicates that 100% of respondents agree that offsets contracts provide flexibility, with local companies able to choose local or foreign content, human resources and machines in the offsets projects.

Table 5.2: Flexibility in Resource Use

Question 6.03 Does the offsets agreement restrict the use of:	**Yes** **(%)**	**No** **(%)**
Local material resources	0	100
Outside material resources	0	100
Local machines and equipments	0	100
Outside machines and equipments	0	100
Local manpower	0	100
Outside manpower	0	100

Source: Survey results, 30 April-31 July, 2005

Most of the agreements were focused on training, transfer of technical instructions, manuals, transfer of technical services and consultancy. These were related to basic technology transfer dealing directly with the maintenance of equipment purchased, becoming part of the main procurement contract. Additionally, the agreements lacked focus on more substantial transfers of technology, such as the transfer of hardware/machinery, components and parts, local participation in R&D, design and construction as well as management.

Table 5.3 shows survey responses in terms of the types of offsets obligations included in the contract. The findings show that the focus has been on basic technology transfer activities, including educational courses, training, transfer of hard and soft technologies and the provision of technical and consultancy services. In terms of prioritisation of activities being included in the offsets contract document, 100% of the survey respondents agreed that contract agreements include educational and training components, followed by 80% agreeing that specialised technical services were also included. Some, 70% of the respondents agreed that their agreements included transfer of technical instruments and manuals. They claim that projects that dealt with manufacturing, assembly and maintenance required manuals spelling out the details of the step-by-step processes. Although 60% of the respondents agreed that agreements included consultancy services, equal numbers also agreed that the contracts allowed for local management participation in the offsets projects to learn side-by-side with consultants, eventually preparing the locals to run the operations independently. Some 90% of the respondents claimed that offsets agreements failed to include transfer of design, specialised research, local participation in R&D and local participation in design and construction. This suggests that R&D did not feature strongly in Malaysia's offsets contract agreements.

It is vital for offsets contracts to capture future business in the agreement, ensuring the continuity and sustainability of the projects. As per Table 5.4, of the total 16, 90% of respondents believed that offset agreements did not include provisions for securing future business, such as buy-back provisions. As the offsets generally did not comprise commercial based projects, there were minimal provisions featuring future business opportunities for the offsets recipient companies. This is a challenge to the local firm, if it is unable to independently market its products overseas once the offsets obligation has been completed. There is thus a real danger that the project may end up being high risk and *one-off*. Besides planning, negotiation and getting contractual terms correct, it is vital to ensure the effectiveness of offsets implementation in realising successful offsets programmes.

Table 5.3: Inclusion of Offsets Obligations in Contract Agreements

(Question 6.02) In the offsets agreement, is there a provision, which obligates the OEM to provide?	**Yes** **(%)**	**No** **(%)**
Educational Courses	100	0
Training Services	100	0
Components and parts	50	50
Specialised technical services	80	20
Transfer of technical instruments and manuals	70	30
Transfer of hardware/machinery	10	90
Transfer of design	10	90
Consultancy service	60	40
Specialised Research	10	90
Local participation in R and D	10	90
Local participation in design and construction	40	60
Local participation in management	60	40

Source: Survey Questionnaire, Malaysia 30 April-31 July, 2005

Table 5.4: Opportunities for Future Business

	Yes (%)	No (%)
Question 6.04 Does the agreement provide opportunities for future business?	10	90
Question 4.06: Transfer of technology through offsets have resulted in the following:		
• turnkey projects	18	82
• buy-back arrangements	6	94
• build, operate, transfer (BOT)	6	94

Source: Malaysia Survey of Offsets Recipient Firms, 30 April- 31 July, 2005.

5.5 Implementation and Monitoring of Offsets

At the offsets implementation stage, the MOD is bound by several steps, including the monitoring the success and failure of the project. Figure 5.3 below outlines the various stages of implementation including: identification and determination of offsets recipients; enforcement of systematic time schedules on the completion of projects; structured reporting mechanisms from the offsets obligors and offsets recipients; follow-up and follow-through of the projects; and penalty clauses for non-compliance. Mr. Abdullah Badawi, Prime Minister of Malaysia (current since 2004) emphasised in his forward note to the 9th Malaysia Plan (2005-2010) that:

Particular attention be given to implementation, coordination and monitoring and evaluation mechanisms to ensure that programmes are effective in attaining the targets that have been set. [32]

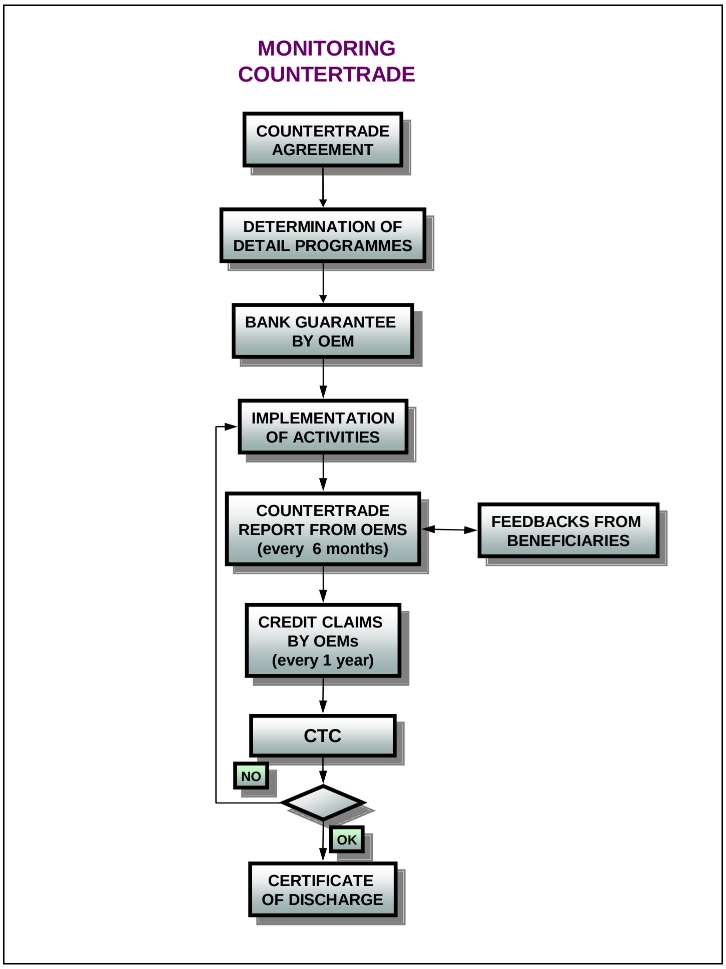
Once a contract has been signed, the countertrade agreement is reviewed and the recipient of each programme is determined. For Malaysia, recipients are decided by the MOD, based on several considerations:

- The dominant recipient shall be a *bumiputra* company.
- The company selected must have the required infrastructure, investment capacity and human resource capability.
- Willingness to invest, partner or collaborate with oversees suppliers.
- Suppliers are normally given a list of companies. These companies are mainly members of the MDIC. Overseas suppliers are encouraged to audit and partner with identified local companies. However, the MOD provides flexibility for suppliers to explore and work with other companies upon consultation with MOD.

At the monitoring stage, the offshore vendor and offsets recipients can independently work on the details of the identified projects with frequent consultation with the DID, providing periodical reports on progress achieved to the DID every six months. Some 90% of the procurement contracts analysed have detailed implementation schedules clearly outlining the stages of fulfilment by obligors.[33] Suppliers forward their claims for credits to the DID every year. The DID, however, lacks a structured reporting system to effectively monitor project progress.[34] Due to the absence of a Countertrade Committee, the reports are presently scrutinised by DID. If project progress is found to be satisfactory, a certificate of discharge is given to the OEM recording satisfactory completion of the programme. [35] A penalty is imposed for no-completed projects.

Malaysia decided to include penalties in its offsets policy for non-fulfilment of offsets obligations as a means of ensuring that obligors adhered to the offsets obligations. OEMs are required to deposit a bank guarantee for non-compliance. The government has taken a flexible approach towards renegotiating project content if requirements become outdated or non-viable.

Figure 5.3: Countertrade Monitoring



Source: Defence Industry Division, 25 June 2006, Ministry of Defence, Malaysia

Survey results in Table 5.5 show that 90% of the respondents agree that OEMs have strictly kept to their offsets obligations.[36] None of the overseas companies has yet paid a penalty due to non-compliance, not least because their ultimate aim is to secure sustainable long-term partnerships with buyer countries. Obligors therefore seek to ensure successful completion of the project without the penalty being imposed.

Table 5.5: Supplier Adherence to Offsets Obligations

Question 6.05	Yes (%)	No (%)	Total respondents
Are the obligations in the offsets agreement strictly followed by the OEMs?	90	10	16

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July, 2005.

According to the DID offsets authority, MINDEF, there have been instances where offsets could not be fulfilled as some of the projects were out-dated or overtaken by events such as the declining need for the technology to be transferred or the OEM's unavailability to find a suitable technology partner. In such instances, the government, together with the OEMs, reach an amicable solution to replace existing projects with other suitable projects. For example, within the Westland Helicopter's (now Agusta Westland) offsets obligation, the transfer of composite technology to CTRM as initially stated in the offsets contract, was found to be overtaken by events as CTRM had already obtained similar technologies from other sources. Westland then took the initiative to substitute this offsets obligation concerned by providing composite-related work to CTRM, which was more commercially viable to both companies. This was agreed by the government as the solution was found to benefit CTRM, the technology recipient. [37]

Regular follow-ups have helped identify teething problems faced by technology recipients. Such problems include applicability of the technology, process and levels of technology absorption and other challenges that impact on the effective transfer of technology to the recipient firm. Table 5.6 provides respondent feedback as to the follow-up and follow-through from OEMs and the government. The results in Table 5.6 indicate that OEMs have been more diligent undertaking follow-ups. This relates to the OEMs' intention not to default on the contracts, thus paying a penalty, as well as the need to sustain good relationships for future contracts. Most of the OEMs view Malaysia as a long term customer and they do not want to jeopardise their relationship due to the failure to perform offsets obligations.[38]

Table 5.6: Follow-Up on Offsets Obligations

Question 6.01	**Yes (%)**	**No (%)**
Is there constant follow-up and follow-through from the OEM?	90	10
Does the MOD constantly monitor your company's offsets strategy?	30	70

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July, July 2005.

On the other hand, the government tries to take a 'hands-off' approach to suppliers and local companies collaborating independently on projects. By contrast, political interference and local industries demand stronger government participation in offsets project determination and monitoring. The government role is arguably to smooth the process of local companies acquiring technology from overseas suppliers. Follow-ups and follow-through from the offsets Agency is often irregular and mostly reactive and not proactive.

5.6 Offsets Scope

5.6.1 Defence versus Non-Defence

To date, 431 offsets projects have been agreed with offshore vendors, of which 48% have been completed, 32% are on-going and 20% are yet to begin.[39] The majority of offsets projects have been direct, defence-related. Data analysis shows that out of the total 431 projects, 321 of them have been focused on direct defence-related work.[40] Of the 321 projects, 60% of them have been targeted on the Malaysian defence industry in terms of training, employment, skills enhancement and innovation. Table 5.7 lists the various offsets projects undertaken by Malaysia under the 7th (1995-2000) and 8th (2001-2005) Malaysia Plans. Most of the projects have concentrated on technology transfer in the form of training, know-how, joint-development, local production, and sub-assembly. The 2006 published offsets guidelines explicitly state that higher weightage and multipliers be given to direct defence-related projects.

Table 5.7: List of Offsets projects under the 7th and 8th Malaysia Plans

Year	Equipment	Offsets Projects
2003	SU-30MKM (Russia)	• Establishment of technical service centre for maintaining and repairing SU-30MKM aircraft. • Development of the programme of logistics support for the technical service centre operation. • Development of full mission simulator for SU-30MKM aircraft. • Training and launching of Malaysian astronaut.
2003	GFE (THALES) SU-30MKM (France)	• Participation in optronic, avionic, communication ICD definition phase. • Participation to integrate optronic, avionic, communication equipment on aircraft. • Advisory support of Thales regarding the setting-up of maintenance facilities. • Maintenance license for optronics to Malaysian industry. • Repair accreditation for avionics.
2002	Scorpene Submarine (France)	• Transfer of technology, namely training in various submarine handling and management.
2000	ACV 300 (Turkey)	• Vendor development-supply and manufacture of parts and components of the vehicle. • Production works (assembly) on ACV300 vehicles in Malaysia. • Installation of vehicle sib-systems locally. • Maintenance training.

Year	Equipment	Offsets Projects
		• Transfer of technology in developing track pads for vehicles.
2003	MBT PT91 (Poland)	• Transfer of technology for final assembly of MBT and its variants. • Transfer of technology for maintenance and repair of MBT and its variants. • Theoretical and practical transfer operation and maintenance. • Local production of parts and components. • Data transfer for spare parts management and maintenance planning system. • Local production of MBT and its variants. • Documentation for MBT and its variants. • Simulator and CBT data for MBT and its variants. • Transfer of process engineering for welding and machining of special steel with practical training. • Transfer of technology for production of rubber pads. • Training/course in defence against NBC weapons of mass destruction. • Training in Poland for horse management. • Transfer of technology for laser technology application.
1999	Superlynx (UK)	• Technology transfer to assist in the establishment of maintenance capabilities for support of the RMN Super lynx helicopters. • Certification of composite facilities and provision of

Year	Equipment	Offsets Projects
		opportunities for manufacture of aircraft composite components. • Development of inventory control and management system for Navy. • Transfer of technology in areas of advanced helicopter technologies and associated subjects. • Technology transfer to assist in establishment of avionics systems technologies and computer maintenance capabilities. • Manufacture of helicopter ground support equipment and opportunities for the manufacture of other aircraft components.
2003	LOH 109	• Development of maintenance capabilities. • Establishment of the helicopter service centre. • Establishment of the engine service center. • Support for the establishment of a multipurpose test bench for gearbox. • Post design support and documentation. • On-the-job training concerning calibration of test equipment. • Flight training centre set-up. • Study visit to Agusta facilities. • Computer based training and cockpit and mission training know-how. • Sub-contract to local industry for helicopter sub-assemblies.
2002	JESNAS Short Range Missile(UK)	• Establishment of tri-service electronic warfare training center. • Transfer of technology through training.

Year	Equipment	Offsets Projects
		• Work experience secondment in the development and management of offsets strategy. • Design, manufacture and support of towing vehicle installation kits. • Design, manufacture and support of combat repair vehicle installation kits (CRVIK). • Manufacture of stowed items/equipment.
2002	CN 235(Indonesia)	• training in: • Aircraft design. • Composite technology. • Aircraft construction. • Flight test. • Aircraft maintenance.
2003	Exocet SM39 Block 2 Missiles (France)	• Training course (basic, intermediate and advance), know-how related to guided missiles technologies. • Engineering session related to guided missile technologies for experienced scientist and engineers. • Transfer of know-how and technology related to intermediate level maintenance.
2002	Black Shark Torpedo 9Italy)	• Support and test equipment (S&TE) adaptation. • Live torpedo runs tactical evaluation. • ILS management. • Torpedo performance critical topics. • Configuration management. • ORACOM 2000 system simulator. • Warhead and explosive for

Year	Equipment	Offsets Projects
		underwater application. • Propulsion batteries site design. • Industrial and management training.
2003	High Performance Human Centrifuge (HPHC) -US	• Transfer of technology in developing a national hyperbaric medicine centre at the school of Medical Sciences (USM). • Training to RMAF Institute of Aviation Medicine (IAM) on GAT II Spatial Disorientation (SD). • Establishment of a local engineering office for the support of the G-FET II and to assist in the coordination of the local manufacturing and product support. • Transfer of technology in local manufacturing and procurement for G-FET II TFS primary components. • Local technology development partners.
2001	Fennec AS555 SN (France0	• Developing cockpit trainer cooperation. • Manufacture of Ecureuil/Fennec service station or O/I maintenance level. • Maintenance support for avionics equipment. • Maintenance support for radar and communications equipment.

Source: Ministry of Defence, Malaysia, June 2005

However, the exact value of the overall direct-indirect composition could not be obtained as most of the offsets projects prior to 2000 did not have a value attached to them. This was because the offsets threshold value and the composition of the different types of offsets were not fixed prior to the written policy. There were also frequent changes in terms of minimum offsets threshold values and the composition of different type of offsets.[41] However, there have been frequent policy shifts between the defence and non-defence offsets composition in Malaysia. The early 1990s, for example, saw an increase in counterpurchase activities, reducing in the mid-to-late 1990s and then a sudden increase again in the late 1990s. Malaysia's demand for offsets is strongly connected to the country's economic climate, whereby during economic slowdowns, the government tends to focus on commodity trading as opposed to enhancing the defence industrial base. In 1997, after the Asian financial crisis, the government sought a quick economic recovery through offset-induced production of commodity trading. This is reflected in the 8th Malaysia Plan where counterpurchase was a prominent feature. Table 5.8 shows the value of defence procurement and offsets under 7th and 8th Malaysia Plans. The DID reported that from 1999-2003, the total counterpurchase value was $381,382,206, which almost equalled the offsets value of $388,638,214.[42] Offsets deals under these plans also featured a high value of indirect offsets, mainly into foreign direct investments and civil technology development, such as GPS and IT projects.[43] Indirect offsets projects provided the milieu to develop the civil aerospace, bio-technology, agricultural, IT and other high-technology sectors. There was a clear policy shift to greater emphasis on indirect as opposed to direct offsets projects.

In the late 1990s, there were increasing concerns amongst policymakers about the decreasing value of defence-related offsets in the development of a sustainable defence industrial base. Issues were raised as to the verification of *additionality* through counterpurchase and the distortions created within the existing commodity market in the search of short-term gains.[44] The DID itself faced difficulty in proving causality and additionality in investment-related offsets. [45]

Table 5.8: Procurement Projects under the 8th Malaysia Plan (2000-2005)

Num	Programme	Contract (Different currencies)	Country	Countertrade (value) %	Offsets (Direct& Indirect) %	Counter purchase %
1	SU30MKM	$900.7	Russia	US540.4 (60%)	30%	30%
2	Scorpene	EU920.4	France/ Spain	EU460.2 (50%)	15%	35%
3	GFE SU-30MKM	EU118.5	France	EU35.5 (30%)	30%	-
4	MBT PT 91M	US370.6	Poland	US222.4 (60%)	30%	30%
5	Exocet SM39 missile	EU131.7	France	EU26.34 (20%)	NA	NA
6	Black Shark Torpedo	EU 87.5	Italy	EU43.8 (50%)	25%	25%
7	Super Lynx	£113.3	UK	N/A	NA	NA
8	LOH 109	$75,339	France	N/A	NA	NA
9	JERNAS	$75,339	UK	N/A	NA	NA
10	High Performance Human centrifuge	$11,055	USA	NA	NA	NA
11	FENNEC	Euro 42,124	France	NA	NA	NA
12	ACV 300	$278,700,500	Turkey	NA	NA	NA
13	G5-155mm	NA	South Africa	NA	NA	NA
14	MRLS Astros II	NA	Brazil	NA	NA	NA
15	CN235	US36,280	Indonesia	US7256	NA	NA

Source: Defence Industry Division, June 2005, Ministry of Defence, Malaysia

Amongst defence contractors, there were conflicts of interest in the transferring of defence technology after the end of the Cold War period. The saturated defence market coupled with increasing competition to obtain sales had caused many of the prime defence suppliers to either merge or consolidate their businesses. Many of them had also lost huge amounts of work, laying-off high numbers of workers. These companies struggled to keep defence work at home. The OEMs are not willing to part with defence-related technology, which could potentially further erode their market potential. Defence suppliers, were keener on promoting non-defence related offsets as compared to defence.[46]

Defence OEMs agree that Malaysia needs to pursue defence industrialisation to support its aim of maintaining self-reliant Armed Forces.[47] Acquisition and absorption of technology relating to the equipment purchased is vital to support the Armed Forces in terms of supplying materials, such as spares and services as these play an important role in directly reducing the through-life-support costs of maintaining the equipment purchased. However, many of the vendors question the need for Malaysia to become a defence platform or equipment manufacturer.[48] The vendors are reluctant to provide defence-related offsets, as opposed to indirect offsets, (mainly civil related-work and investments). Some 80% of the vendors interviewed regard defence work undertaken by 'small' developing countries as economically inefficient, requiring large capital outlays, incurring long lead-times for returns and carrying uncertainty in terms of recurrent volume and export performance.[49] Overseas defence suppliers see these potential new entrants as further saturating an already over-crowded international supply base.[50] Suppliers look at indirect offsets as a better option for smaller developing countries to sustain their market position. Malaysia, for example, is identified as being able to perform better by focusing on initiatives such as biotechnology, healthcare, and ICT, arguably having a greater impact on national development. [51]

5.6.2 Source of Offsets

The sources of innovation, in relation to country-origin, and degree of dependency (see Chapters 2 and 3) affect local absorption of technology. For Malaysia, technology has been sourced from many different countries. Weapons have been purchased from a wide variety of countries, including the US, the UK, various EU countries (such as France, Germany and Italy), Eastern Europe (Russia and Poland) and other developing countries

(Brazil, South Africa and Turkey). These purchases have created a range of expertise and logistical problems within the Armed Forces and defence industry. Diversified technology capabilities, from West and East, with different technical standards and specifications, have created complications in terms of integration of the various equipments for interoperability and capability within the Malaysian Armed Forces. This has challenged the learning process and technological capability with the industry as well.[52] The problem is that firms need to be familiar within different manuals, standards of instructions, rules and guidelines for the defence technology transfer process.[53]

The overall experience of diversified procurement has also limited local technological capability and caused increased development costs due to the frequent need to adapt to differing countries technology processes. These include modification of infrastructure and hardware (such as jigs and tools) to suit each supplier's technology transfer requirements. At the same time, some of the OEMs view this logistical complexity as high risk, given that technology could leak to competitors via Malaysian companies.[54]

5.7 Role of the Malaysian Government in Sustaining a Defence Industrial Base

Government plays a vital role in the structural support of economic development (see Chapter 2). Government is one of the principal actors ensuring the success of a nation's technological and industrial development. Government decides on policies aimed at providing an appropriate climate for development. The role of government is thus essential in identifying crucial developmental indicators for the creation of a competitive and high-value added technological environment. For Malaysia, the national goal has been to transform the economy from one based on agriculture to instead a more diversified manufacturing economy. The government has played an active participatory policy in promoting industrialisation through ISI and EOI strategies, incorporating Western as well as East Asian economic models to enhance the industrial base. Today, the government's key agenda is to create diversification in various high-technology sectors, including defence.

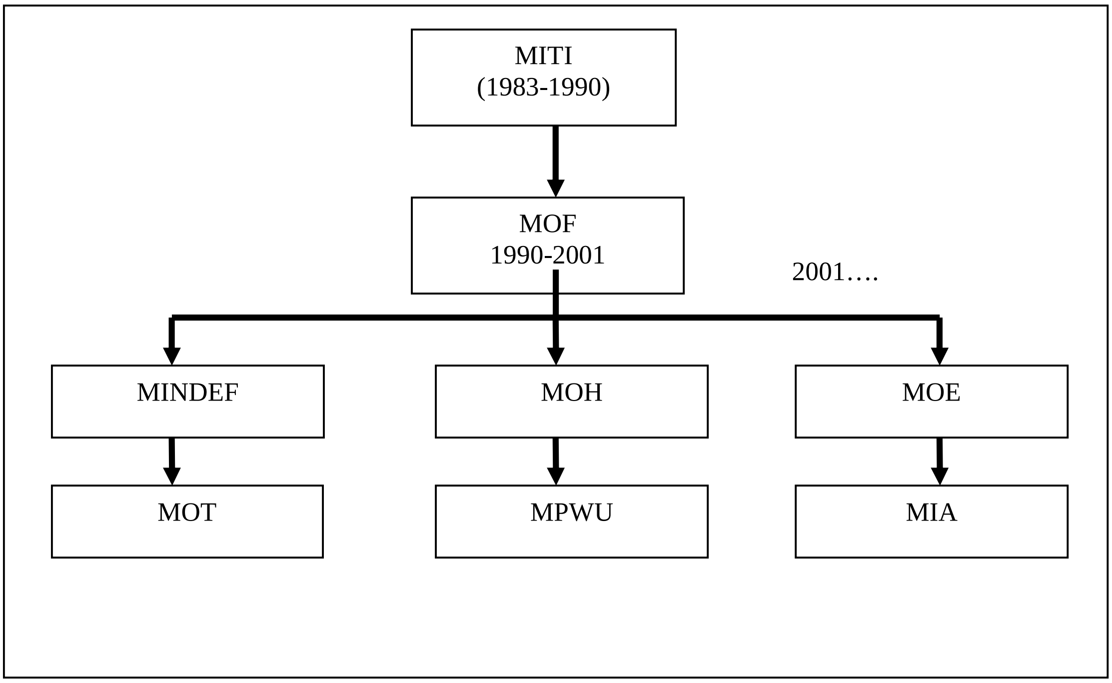
5.7.1 Government Initiatives Aimed at Raising Offsets Effectiveness

The Malaysian government is committed to the development of its defence industrial base. Offsets are used as the main instrument towards achieving this objective, with policies concentrated on the formation of an offsets policy to capture high value-added projects through joint-ventures, and co-production, leading to indigenisation and exports. The task of offsets management, as discussed earlier, was transferred from MITI (1983-1992) to the Ministry of Finance in 1992. This transition of function was in parallel with the introduction of offsets in Malaysia through the purchase of Hawk aircraft from BAE in the early 1990s. The special offsets unit at the MOF was tasked from that time to coordinate, manage and implement offsets projects. The MOF invited relevant stakeholders to participate in offsets negotiation before projects are finalised. All offsets policy and implementation matters fell within the purview of MOF with a minimal role for the ministries purchasing the capital items. The government's first initiative to increase offsets effectiveness was to decentralise offsets implementation and monitoring to the relevant ministries in 2001. It was realised that it is vital for implementing ministries to be directly involved in offsets decision-making and negotiation processes to obtain the best possible project outcomes. This move was also expected to give the respective ministries the opportunity to plan and coordinate their offsets projects in parallel with procurement activities.[55]

The task of offsets management was delegated to six key ministries: the Ministry of Defence (MOD); Ministry of Health (MOH); Ministry of Education (MOE); Ministry of Transport (MOT); Ministry of Internal Affairs (MIA); and the Ministry of Public Works and Utility (MPWU). This decision was taken on the basis that the relevant ministries would have the expertise and skills to better manage their respective offsets projects.[56] The MOF, however, still retained responsibility for all offsets policy matters. The transition of the offsets management responsibility is shown in Figure 5.4.

The government's decision to decentralise offsets management was a step forward, ensuring that stakeholder ministries were involved in securing relevant and high quality offsets projects. For the MOD, with the largest amount of offsets obligations, this action was viewed as a positive move towards ensuring that the defence sector, particularly the defence industry, benefitted from defence offsets. Further, the government's initiative to formalise offsets policy was seen as a step in the right direction in the provisioning of a transparent and systematic methodology for the design and implementation of offset programmes.[57]

Figure 5.4: Offsets Management Transformation (1983-current)



Source: Author

As Malaysia's public sector, particularly the MOD, is directly involved in the technology identification and selection process, the government wants to ensure that there is an effective process for obtaining the right sort of technology based on national need. The government has believed for some time that the *ad hoc* nature of compiling a technology wish-list was not producing adequate technology development capability within the defence industry.[58] Thus, as a follow-up to the MIGHT Report, the MOF decided in 2005 to form the Technology Depository Agency (TDA) under the responsibility of MIGHT. MIGHT was thereon responsible as a 'technology bank' for the compilation of a technology wish-list for the MOD to leverage crucial technology. MIGHT's role includes:

i. Identifying technological needs.
ii. Recommending on how best to, acquire, exploit, receive and house the technology.
iii. Ensuring both (direct and indirect) offsets are effectively used to assist economic growth.
iv. Ensuring technology is procured successfully and transferred to local recipients monitoring offset implementation.[59]

Further, the MOD through the MDIC platform created a joint R&D fund to encourage public-private defence R&D ventures. The fund was to operate via a joint-funding type of collaboration.[60] The Government took the initiative to formulate a defence industry blue-print.[61] This document was meant to be a guideline for the development of a local defence industry, identifying and prioritising strategic technology with both a short- and long-term vision of creating a sustainable Malaysian defence industrial base.[62] The blue-print, however, remains to be approved and formalised.

The government also took initiatives to create defence industry clusters through offsets. In this respect, offsets were used to develop SMEs through the vendor development programme. Under this initiative, an identified Malaysian prime contractor would be awarded an offsets project. The government would then expect the Malaysian prime to sub-contract work within the offsets project to Malaysian SMEs. The government's intention was, and is, to create defence industrial clusters and enhance backward linkages. This policy was initially applied to the 1999 Patrol Vessel project, which was undertaken by PSC Naval Dockyard (further details about this project are discussed in Section 5.4.7).

The government is easily the largest procurement source for products and services from the local defence industry. For 2005, the government procured RM 6.46 million in terms of products and services from local defence industry.[63] The scope of government procurement varies from purchasing small essential items and services to obtaining through-life support, including maintenance, up-grade, assembly, as well as the procurement of high-tech equipment, such as simulators, trucks, combat vehicles, ordnance and weapons. The government, to support sustainable defence industries, has implemented a long-term contract policy, providing continuous work to defence companies for a period of 5-10 years, depending on their capability. This move will encourage local companies to invest in infrastructure and manpower development.

5.7.2 Challenges Faced by Government and Offsets Implementation

The Malaysian government faces several challenges in its efforts to promote defence industrialisation. The absence of a defence policy outlining the nation's security environment, threat perception, defence capability, and procurement strategy has direct implications on the formulation of a defence industrial policy. There appears a lack of direction amongst policymakers in developing strategies to enhance the Malaysian defence industrial base, due to the absence of focussed policy guidelines.

Technology selection, coordination and prioritisation are still a problem despite the presence of the TDA. There exists a huge gap between the MOD as the implementing Ministry and MIGHT, due to the differences in focus within the high technology sectors. MINDEF aims to use offsets to develop, particularly, the defence sector. By contrast, MIGHT as the umbrella organisation for high technology, focuses on the civil and aerospace high technology sectors. Further, there is clear lack of coordination between MIGHT and STRIDE in relation to determining and prioritising the technological needs within the defence sector. MIGHT, is at the early stages of policy formulation, and therefore is still experimenting on the effective utilisation of TDA. MIGHT also lacks human resources to evaluate technological needs.[64] Currently, 100% of staff in the TDA is seconded from the Armed Forces.[65]

In terms of export and marketing promotion, the government's explicit intention is to promote Malaysian defence exports, but this is not accurately reflected in its policy. As a result, offsets agreements are devoid of any export or buy-back provisions; an issue that will be discussed in more detail later in this chapter.

5.8 Impact of Offsets

5.8.1 Technology Absorption and Capability Development

Technology capability resides at several levels (see Chapters 2 and 4). In the defence sector, technology capability at the most basic level involves the capacity to undertake activities such as production, operation, maintenance, repair, overhaul (MRO), up-grade, assembly and resource allocation. At the higher stages, this capability moves on to acquiring capability for joint-ventures, co-production and licensed production. Finally, at the highest level, technology capability centres on innovation leading to indigenisation.

In the past 15 years, Malaysia has used offsets to build its defence industrial base. Technology absorption involves various levels of technology learning such as learning-by-doing, adaptation, and basic R&D, leading to innovation. The purpose of this section, then, is to analyse the impact of offsets on the development of technology capability, leading ultimately to innovation of new technologies and R&D.

Offsets have successfully targeted *bumiputera* entrepreneurs and workers, developing their capabilities in high-technology sectors, such as defence and aerospace. Malaysia's defence industries are almost 100% owned by the *bumiputras*, and the majority of the workers are Malay.[66] These companies are mainly small to medium size firms, 80% privately owned, with 70% having businesses in both the civil and defence sectors.[67]

5.8.2 Technology Learning and Capability Building

The technology transfer process has already been discussed (Chapter 2) whereby the firm selects the technology, acquires it, and then goes through the process of development, application, diffusion and management of the technology. However, in some instances within developing countries, offsets reciepients and projects are identified and selected by the government. Once the type of technology and the recipients have been identified, the technology transfer process, including technology learning, adaptation and innovation at the industry level involves the following steps:

i. Company informed that it has been selected as the technology recipient.

ii. Company invited during the negotiation stage to discuss technology issues, including, transfer strategy, pricing, infrastructure and man-power capability.

iii. Supplier conducts audit on the recipient company to gauge its technology absorption capability and suggest up-grades and possible infrastructure that need to be in place to smooth the technology transfer process.

iv. Local firm identifies possible technology gaps and works with the identified OEM and MINDEF to put in place the appropriate infrastructure before the project is implemented.

v. Acquisition through offsets of hardware, such as jigs, tools and machinery if the local firm is unable to acquire these items in a short period of time; or if specified in the contract.

vi. OEMs transfers the necessary documents, provides training locally and overseas, both in the form of theoretical classroom teaching and hands-on technical and know-how training at the OEM's facilities abroad.

vii. Local firm absorbs the technology at various levels, including the process technology, management techniques, production know-how and product technology.

viii. OEM and recipient firms seek to stay within the project implementation schedule of the offsets contract; the OEM to commit to working towards meeting this deadline in order to not be penalised.

ix. Periodical follow-up and follow-through from the OEM before reports are submitted to MINDEF on project progress.[68]

Malaysian inward technology transfer is divided into six categories, as shown in Table 5.9. The breakdown is categorised as transfer of technology (TOT), maintenance, repair and overhaul (MRO), manufacturing, sub-assembly, integrated logistics systems (ILS) and research and development.

Table 5.9: Types of Offsets Activity

Type of activity	**(%)**
Transfer of Technology	58
Maintenance, Repair and Overhaul(MRO)	18
Manufacturing	8
Sub-Assembly	10
Integrated Logistic Systems(ILS)	5
R&D	1

Source: Ministry of Defence, Malaysia, June 2005.

As per Table 5.9, above, 58% of offsets are focused towards technology transfer. The technology transfer component can be sub-divided into training, know-how, technical assistance, consultancy and documentation as well as the transfer of hardware. The results from the questionnaire and analysis of the offsets programmes revealed that 70% of technology transfer is focused on training of the Armed Forces and industry personnel selected to handle the main equipment and the sub-systems purchased.[69] Training includes theory and on-the-job training, conducted both locally and abroad. Technical assistance and documentation are also provided through offsets for the equipment purchased. Consultancy services are provided by foreign suppliers for a short duration or until the end of the warranty period.

The second largest type of offsets involves the MRO type of activities (18%), mainly second and third level MRO.[70] In such instances, local companies are selected by the MOD to provide MRO services for the Armed Forces after the warranty period expires. Normally, the selected company's personnel will have to undergo training on how to service the equipment purchased and this is captured by offsets. A few military personnel will also be selected to learn MRO at the second and third level in order to be equipped in emergency situations. MRO activities are currently being undertaken in Malaysia by companies like Zetro in avionics maintenance, Airod in engine maintenance, Caidmark in Condition-Based Monitoring, and Sapura and SCS in simulator maintenance.[71]

The third largest type of offsets activity involves sub-assembly (10%) where locally identified defence company personnel will be selected to learn and assemble a certain percentage of the defence equipment in-country. A Malaysian major sub-assembly project, involving the ACV 300 (Adnan) was purchased from Turkey, and 64 out of the 204 vehicles were assembled locally by DEFTECH. DEFTECH a subsidiary of EON Berhad was selected as the prime contractor for the offsets project. With regards to the offsets deal, DEFTECH undertook to carry out in-country tank assembly. DEFTECH claims that through this technology transfer process, DEFTECH workers were able to obtain capability to design and produce simple tanks for the Malaysian Armed Forces.[72] Another example of an offsets sub-contracting project is MMC Defence's on-going contract to assemble MBT-PT91 tanks from Bumar Labedi, Poland. According to MMC personnel, several of the company's workers, through this project, have been sent to Poland for training on processes related to the tank.[73]

Manufacturing forms 8% of offsets[74] and integrated logistic systems (ILS) forms 5% of Malaysia's offsets activity.[75] This includes activities in logistics support, integration and simulator development and other electronics and electrical-based types of activity. Finally, design and development form only 1% of offsets activities. Several research projects involving R&D were carried out via defence offsets, but these projects were mainly diversified activities, mainly in the civil sector.

5.8.3 Technology Collaboration

In terms of technology collaboration, Table 5.10 shows that there have been joint-ventures, co-production, sub-contracting, collaboration, buy-back arrangements and BOT with overseas firms. Of the 16 companies that responded to the survey questionnaire, 50% claimed to have technology partnerships through sub-contracting work, 44% through collaboration, 38% through joint-ventures, 31% through co-production and licensing, and just 6% through buy-backs and BOT.

Table 5.10: Technology Collaboration

Question 4.06:Transfer of technology through offsets has resulted in the following:	**Total (%)**
Joint Ventures	38
Collaboration	44
Sub Contracting	50
Co Production	31
Licenses	31
Buy-back arrangements	6
Build, Operate, Transfer(BOT)	6

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2005.

Offsets projects have created partnerships across various companies and countries across a broad range of technology transfer activities. However, these have been mainly basic technology transfer types of activities where technology transfer involves the transfer of hard and soft technologies, involving minimal innovation, mostly ‘build to print’ requiring local firms to stick to product and process specifications identified and set by the OEMs.

Table 5.11 below shows the break-down of technology-transfer according to the type of activities from the USA, Britain, France, Italy, EU, Canada, South Korea, South Africa and Germany. The partnerships are analysed in relation to joint-ventures, co-production, sub-contracting and collaboration. Table 5.11 shows that Malaysian companies have relatively more sub-contracting and collaboration types of technology transfer activities with US (4 sub-contracting and 5 collaborative activities) and UK companies (5 subcontracting and 4 collaborative activities). Overall, Table 5.11 illustrates that the numbers across the board in terms of joint-ventures and co-production activities are minimal indicating that offsets have not been able to create substantive technology partnerships between overseas and Malaysian companies. Many of these companies claim to have been provided with extensive training and consultancy services. Offsets projects have been merely at the basic technology level, involving training, technical assistance, manufacturing, sub-assemblies and simple MROs. There is a clear absence of more sophisticated types of technology collaboration through offsets in the defence sector.

Table 5.11: Countries Engaged in the Different Levels of Offsets Activities

Please specify the country engaged in the highest levels of Offsets	**Joint venture (Num)**	**Co-production (Num**	**Sub-contract (Num)**	**Collaboration (Num)**	**Others**
USA	3	-	4	5	Training
Britain	2	2	5	4	
France	1	1	1	3	Consultancy
Italy		1	3	1	Training
Other EU (Germany)		1	2	1	
Canada	1		1	1	Training
South Korea		1		1	Training consultancy and Manufacture
South Africa				1	Training and consultancy
Switzerland				1	

Source: Malaysia Survey of Offsets Recipient Firms (July 2005)

Offsets have been the main source of technology transfer for local companies, but they have sourced technology through various other options besides offsets. Table 5.12 shows that of the 16 firms that responded, 25% of the respondents claim that they have

have obtained technology through through bilateral arrangements, 38% claim to have obtained technology through technical cooperation, 19% through joint-ventures and 13% turnkey projects. However, 56% of the respondents claim that their main mode of technology transfer is through offsets. This indicates that offsets have been the main source of technology for the majority of Malaysian defence industry.

Table 5.12: Modes of Technology Transfer

Question 4.03: If an innovation has come from another country, how was it transferred?	**Numbers of Companies involved (%)**	**Total Respondents**
Bilateral arrangements	25	16
Technical Cooperation	38	16
Direct Joint Ventures	19	16
Turnkey	13	16
FDI	-	16
Offsets	56	16

Source: Malaysia Survey of Offsets Recipient Firms, 30 April- 31 July 2005.

Local firms have initiated innovation strategies through collaboration with local universities, such as UTM, USM, UiTM, USM and research organisations, such as STRIDE. CAIDMARK and STRIDE, for example, have collaborated in joint-research in software modelling. These two organisations have also signed an MOU for R&D collaboration in condition based-monitoring, inclusive of aircraft structural integrity programmes.[76] Astronautics Tech (M) collaborated with SIRIM on ISO, with USM on an aerospace research programme and remote sensing with UPM on aerospace research programmes and with UiTM on electronics/mechatronics RF and antenna system.[77]

Chapter 4 discussed the need for local firms to become self-reliant, in terms of sources of technology, raw materials and skilled workers. Table 5.13 shows that the 16 respondent local firms sourced technology, components, parts, machinery, specialised research, training services, consultancy services, raw materials and skilled workers, both abroad and locally. These resources were sourced from mainly the US, the EU and Japan.

Table 5.13: Source of Technology

Question3.07:Does your company source the following:	**Local (%)**	**Foreign (%)**	**Both (%)**	**Total Respondents**
Technology	25	44	31	16
Components and parts	25	38	37	16
Machinery	19	38	43	16
Specialised research and training services	25	38	37	16
Consultancy services	25	44	31	16
Raw materials	31	38	31	16
Skilled workers	38	25	37	16

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2005.

Some 38% of respondents, as shown in Table 5.13, relied on foreign sources of technology, components and parts, machinery, specialised research and training services and consultancy services to enhance their technological and industrial capability. Some 31% of respondent firms claimed to have sourced a fairly low amount of raw materials in-country and 38% of respondents claim to be highly dependent on imports of raw materials and machinery. Raw materials are vital to enhance and sustain competitiveness of the industrial base. Malaysian companies have had problems in producing raw materials and machinery in-county and are still highly dependent on imports such as steel, composites and 5 axis machines.[78] Some 44% of respondent firms source technology and consultancy services from overseas for their industrial development, indicating that there is significant amount of technology transfer from overseas suppliers for hard and soft technology. The only area where local sources are used is skilled workers. Some 38% of respondents claim that Malaysia is still competitive in terms of the cost of high skilled workers. [79]

Although Malaysia utilises offsets in developing its defence industrial base, success has been achieved only to the extent of first and second level capability, with minimal third level development processes and product innovation. Finally, there has been hardly any success in terms of R&D from offsets activities.

5.8.4 R&D Strategy

R&D investment is critical for ensuring a successful technology absorption process, leading to indigenisation and ultimately export. Creation of new technologies, especially product technology, involves a huge investment in R&D. The commitment of Malaysian companies towards R&D activities has been minimal. Some 70% of the Malaysian companies interviewed (see Table 5.14) spend less than 10% of annual revenue on developing new technologies. There have been minimal exports generated through R&D activities. The few defence exports that have been achieved have been in sub-contracting work, where there is no room for new research except to duplicate existing processes for production.[80]

Table 5.14: Company Annual Expenditure on R&D as a Percentage of Revenue

Question 3.02: Indicate your company's annual R&D expenditure as a percentage of revenue:	Respondents	Total no of respondents
Less than 10%	10	16
11-20%	2	16
21-30%	3	16
31-40%	-	16
41-50%	1	16
Greater than 51%	-	16

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July, 2005.

Zetro Aerospace, for instance, invests in R&D to develop and integrate software. Several smaller companies, such as Ikramatik and UPECA, dedicate a bigger share of their revenue towards R&D. Ikramatik has been actively involved in R&D for simulator development. These companies have on their own initiative invested in R&D, instead of being dependent on government funds. The R&D component, however, comprises only 1% of Malaysia's total offsets obligations.[81] Public-led research institutions are less commercially focused. The R&D fund set-up by STRIDE for public-private research collaboration in defence technology is yet to take-off due to the lack of investment initiatives from local firms.

Some 88% of Malaysian defence and aerospace firms do not have R&D facilities as illustrated in Table 5.15. Zetro, for example, has a laboratory in KLIA to conduct software development testing. Others such as Cairdmark, Sapura Defence and Ikramatik, do have R&D facilities, but 60% of these firms have in-house R&D laboratories that are ill-equipped.[82] Thus, there is little real R&D activities in the Malaysian defence industry.

Table 5.15: Company R&D Facilities

Question 3.03:	Yes (%)	No (%)
Does your company have R&D facilities?	12	88

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2005.

Local firms blame the government for the lack of defence R&D funding. The survey response (Table 5.16) indicates that 14 out of 16 respondents agree that there is insufficient R&D support in terms of financial allocations and incentives to the local defence companies to prop-up their technology innovation capabilities. All 16 repondents state that they do not receive any form of tax credits for R&D activities from the government.

Table 5.16 : Government R&D Support

Questions 3.05 and 3.06:	Yes	No	Total respondents
Question 3.05: Does your company receive R&D assistance from the government?	2	14	16
Question 3.06: Does your company receive government R&D tax credits?	0	16	16

Source: Malaysia Survey of Offsets Recipient Firms (July 2005)

Malaysia's lack of R&D is due to several reasons. These include the lack of government investment in defence R&D, the paucity of corporate investment into R&D as well as the lack of R&D activities being leveraged through offsets in the Malaysian defence sector. According to a MOD senior officer, R&D activities supported through offsets have not only been minimal but also short term as most of the firms participating in the programmes do not develop further research on these technologies for the purposes of commercialisation. Zetro, for example, has entered into an R&D project with STRIDE and PUSPEKA, but is uncertain of the project's commercial viability. Most of the offsets projects are abandoned after in-depth and extensive training has been provided, creating 'one-off' effects. R&D projects which are government-led also face challenges. The Science University of Malaysia which was awarded the contract to upgrade the HUGE air-defence radar in Western Hill, Butterworth, faced difficulties to proceed, and finally had to seek Zetro's assistance.[83]

Further, the government as well as technology recipients are not able to benefit from technology transfer due to the absence of immediate returns and the high investment risks involved.[84] Within national R&D initiatives, organisations such as Intensification of Research in Priority Areas (IRPA), do allocate financial resources to R&D. However, only a small fraction of this is allocated towards defence, as this sector is not seen as a profitable industry generating commercial returns to the nation. STRIDE, for example, was only allocated RM 21 million out of the total RM 3,868 million of the national R&D budget under the 9th Malaysia Plan.[85] The defence sector is felt to be a strategic industry contributing towards military self-reliance, but not as an income generating industry by those outside the MOD. [86]

The low status of defence R&D in Malaysia's defence industry is shown in Table 5.17, below. The Table shows that no patent registrations have been registered by any of the companies surveyed. This is an indicator of how technology transfer had failed to create sustainable long-term defence business, enhancing local firms to *Malaysianise* their products for the export market.

Table 5.17 : Patent Registrations

Question 3.08:	**Yes (%)**	**No (%)**
Does your company have any patent registrations?	0	100

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2005.

5.8.5 Technology-Sharing Problems

Technology-sharing problems include the unwillingness of suppliers to share the contents of 'black-boxes' with the recipients firms due to the threat of competition, the lack of investment initiative from local firms, and the high cost of royalty payments for the technology. Some 6 out of 16 respondents interviewed, claim that they have experienced technology-sharing problems with their overseas partner. Zetro Aerospace had problems in the technology transfer process in its efforts to develop a radar system, due to the large royalty payments required by Alenia Marconi. This technology partnership faced troubles and required government intervention.[87] ATSB also had problems in the technology transfer process when the facilities to assemble and test components for a thermal vacuum chamber (TVC) were not available in Malaysia.

Suppliers involved in technology transfer face government restrictions and export control regulations. Companies are prepared to transfer licensed-based technologies but subject to national authorisation**.**[88] Some 80% of OEMs claim to have invested in critical operational areas, such as systems and technology components.[89] There is a need to achieve and preserve competitive edge in system/product performance, technical strength, independence, innovation potential, and economic competitiveness. 'Core technology' to the OEMs reflects their intellectual property rights and these are unlikely to be given away free.[90] Suppliers are willing to partner with local firms provided there is direct participation in the investment of the supplied system, including sharing of development costs, risks, through-life support and upgrades.

The Malaysian government has been supportive of technology transfer to local firms. Some 90% of respondents agree that they have not had any difficulty with the government in technology acquisition. One particular company faced challenges when it was denied access to the equipment or facilities, thus failing to appreciate the problems with regards to technology acquisition.[91] Sometimes, the local company has had to cater to the design changes requested by users to meet operational requirements.[92] A further example regards a UK company, Elvis Bridging, which faced technology transfer problems involving composite rails. These included the ability of CTRM workers to consistently produce the required quality of rails in its factory, as compliant with specifications. Elvis personnel were placed on the shop floor at CTRM to provide training to CTRM workers, ensuring that the manufacturing procedures and outputs were compliant. [93]

When sourcing technology from other developing countries, the issue becomes more complicated. Defence suppliers almost never hold the IPR (or the ‘black-box’) and will need to seek approval from the OEMs concerned. For example, when Malaysia bought 300 APC tanks from FNSS Savunma Systems, Turkey, there were complications over technology transfer to DEFTECH, the nominated Malaysian company. This was mainly because FNSS Savunnma had to refer constantly to its US technology partner regarding US ITAR (United States International Traffic & Arms Regulations) before it could transfer the technology work concerned to DEFTECH [94] This further escalates the costs of technology as well as increasing the time-lines, as the process involves technology export approvals from several countries.

Most governments adhere to the principle of free, open and competitive trade. However, in the case of defence exports, technology supplier governments often impose various restrictions on technology transfer. This is based on the background of the country, political stability, operational issues, technical issues, and most importantly, high level government-to-government collaboration, based on national interest and the protection of ally States. Malaysia, based on its membership of various international organisations, and its support for UN programmes, has gained recognition from governments as a country with a sound politico-economic policy. The transfer process through offsets has suffered minimal difficulties, though inward technology transfer policy has varied where some of the exporting country policies have been more stringent than others due to various security, political and economic reasons. However, Malaysia has not penalised offshore defence contractors because of their government’s technology restriction policies; the evidence shows that Malaysia has continued to buy weapons even from countries with tough technology export policies.

Malaysia’s export policies are supportive not only of protecting its own defence industrial base, but also overseas sales contracts. Technology exports from the Eastern bloc have proven to be more complicated due to *red tape* and stringent technology export clearance controls imposed by their governments. For example, ATSC, a Malaysian company based in Kuantan, Pahang, was nominated as the Service Centre for the Russian MIG but it faced serious technology transfer problems and spare-parts management from the Russian company, RAC MIG, (now called Rosoroboronexport).[95] Although RAC tried to smooth the transfer process, the overseas company was still bound by the Russian government's technology export rules.[96]

5.8.4 Human Resource Development

Malaysia focuses on human resource development through offsets as a means to train and enhance manpower. Workers hired by the local companies are mainly from local institutions with various levels of educational background. Table 5.18, below, shows that out of the 16 respondents of recipient companies interviewed, 15 of them had more than 20% of their workers involved in operational work, followed by 13 with more than 20% in maintenance work. In fact, only five of the respondent companies have more than 20% of their workforce in management work, and two with more than 20% in R&D related work. The distribution of human resources reflects two issues. Firstly, at the firm level, human resources are heavily concentrated on operational and maintenance activities. Secondly, training through offsets projects has only been undertaken at lower levels of activity, as opposed to R&D.

OEMs, however, are positive about the capability of the Malaysian workforce. Some 90% of the suppliers interviewed claimed that there is a cooperative spirit between the Malaysian workforce and technology suppliers; the local workers are reliable and have a positive attitude towards work.[97] Table 5.19 shows the composition of workers according to their educational background. The Table shows that 11 out of the 16 companies have more than 20% of their workers with vocational school qualifications and 10 out of 16 have more than 20% with university degrees.

Table 5.18 : Proportion of Workforce According to Activity

Question 2.04	Less than 20%	20-40%	40-60%	60-80%	80-100%	Total respondents
Management	11	5	-	-	-	16
Operation	1	4	2	8	1	16
Maintenance	3	8	4	1	-	16
R&D	14	2	-	-		16

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2007.

Table 5.19 shows that 100% of the companies have less than 20% of workers with only primary school qualifications.[98] This suggests that the majority of local firms employ workers with good basic qualifications, either a university degree in a relevant field or a diploma from a technical or vocational school. This also indicates that these workers should be able to absorb the transferred know-how. One supplier mentioned that Malaysians have a *customer-oriented mind*.[99] Senior and middle level management possess strong English skills and have no problems understanding the manuals and documents provided by the suppliers.[100]

The issue is whether the skills of this local workforce are utilised effectively to undertake high level technology development work appropriate to their educational qualifications. There is a danger of creating a less technologically demanding environment for human resource development in Malaysia's defence industries. This situation is exacerbated if the type of work transferred through offsets is mainly low-level operational and maintenance activities.

Table 5.19 : Distribution of Workers According to Educational Level

Question 2.03	Less than 20%	20-39%	40-59%	60-79%	80-100%	Total respondents
Primary school	16	-	-	-	-	16
Secondary school	12	1	1	11		16
High school completed	2	4		1		16
Vocational school completed	5	7	3	1		16
University Degree completed	6	4	2	2	2	16

Source: Malaysian Survey of Offsets Recipient Firms, 30 April-31 July 2005.

Further, as illustrated in Table 5.20, there is a weak commitment from local companies towards human resource development. Some 50% of local firms invest less than 10% of total revenue in the training of human resources. Firms appear to use offsets largely to support focused training activities. The offsets vehicle, contrary to the policy of enhancing skills in high technology areas, has largely been geared towards basic training of workers in the operational and maintenance spheres.

Several local firms still lack the human resources to undertake high-end jobs in certain specialised fields. This has created the need for local firms to import skilled workers from overseas, such as India and Indonesia, capable of working on CAD/CAM and designing.[101] Graduates from local universities, such as UTM, USM and technical and vocational institutes, are claimed to have the theory but not the ‘hands-on’ technical skills. To ensure production quality, many of these firms provide in-house training to newly appointed workers despite the loss of time and additional costs incurred.[102] Further, many of the local graduates have to be provided with translated documents in the native Malays language, slowing the overall process of technology transfer.[103]

Table 5.20 : Annual Corporate Expenditure on Training as a Percentage of Sales Revenue

Question 2.05: Your company's annual expenditure on management training and skill development as a percentage of revenues	**Total (%)**
Less than 10%	50
11-20%	25
21-30%	6
31-40%	-
41-50%	13
Greater than 51%	6

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2005.

Instances of English language deficiency amongst local workers raise the question as to the quality of local educational instruction within the technical and vocational schools. The question is whether these organisations survey the needs of local firms to ensure that the curriculum incorporates industrial development methods and procedures relevant to rapid technological change. Indigenous firms also face high attrition rates of skilled workers. There is an imbedded culture of job-hopping in search of more lucrative salaries within the local community due to the high demand and lack of supply for human resources with specialised skills. [104]

Several offsets recipient firms still rely on consultants for various high technology works. The offsets policy emphasises co-development in the form of co-production and licensed production to encourage on-the-job training amongst Malaysian firms. The frustrations of some local firms arise due to the inconsistency in the selection of final technology recipients. In some instances, the offset project is subsequently not awarded to firms that had been encouraged to invest in worker training; these workers then not being mobilised effectively, resulting in redundancy and inefficient usage of manpower and capital resources. [105]

5.9 Industrial Transformation through Offsets

The aim of every nation is to maximise the benefits of offsets through economic multipliers, such as employment, skills enhancement, innovation, technological spin-offs, value-added supply chains, exports and marketing. In Malaysia, offsets have had mixed outcomes, both positive and negative. In the context of developing a sustainable defence industrial base, Malaysia has successfully used offsets to foster basic technological development in the defence sector but has not yet been able to create high-level innovation resulting in indigenisation and a sustainable defence industry. Nevertheless, offsets have been able to create diversification in the civil sectors, especially aerospace and electronics. This section further elaborates on these issues.

5.9.1 Technology Innovation and Competitiveness

Local firms have been able to utilise offsets to absorb and create technologies, as shown in Table 5.21, below. There are four types of technology capability developed within the recipient firms. These comprise process technology, production know-how, management techniques and product technology.

Table 5.21 : Types of Technology Transferred

Question 4.07: In your company, do offsets transfer the following types of technology?	**Yes (%)**	**No (%)**	**Total (%)**
Process technology	94	6	100
Production know-how	88	12	100
Management techniques	81	19	100
Product technologies	75	25	100

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2005.

The study found that 94% of recipient firms agree that offsets have been able to transfer process technology, 88 % agree to the transfer of production know-how, 81% to the transfer of management techniques and 75% to the transfer of product technology. In relation to process technology, managers and engineers handling offsets projects have built on the existing processes and procedures to make the project more cost effective to meet the high expectations for product quality and price. Several offsets recipient companies have been awarded certification for their process innovation in terms of ISO certification. Such certification has enabled firms to secure contracts via competitive tendering at the international level. These include companies such as SME Aerospace, UPECA Engineering, Airod and Zetro Aerospace.

Companies have also gained know-how to enhance product technologies. A successful defence-related R&D investment has been the local development of simulation visual systems and databases by Sapura Defence. Sapura was appointed as the recipient of technology from TTSL, UK, for the 1992 Hawk simulators under the BAE Systems Hawk offsets project. Based on technological collaboration, Sapura was then appointed by the Malaysian government to maintain the Hawk simulators. In 1993, when Malaysia bought the MIG-29N from Russia, Sapura was again selected to obtain training from CAE, Canada, to jointly develop the simulator for the MIG29. In 1995, when the government purchased the F18s, Sapura was once again nominated to supply training on the F18 simulator offsets programme.[106] Based on these experiences, Sapura was able to absorb, learn, adapt and finally design its own simulator for the Indonesian CN235 aircraft and the Turkish ACV 300 tanks. Sapura was able to obtain further capabilities in simulator development through offsets including the comprehensive maintenance of simulators, upgrading of existing simulators, and, finally, indigenisation leading to development of visual databases. With these capabilities, Sapura was able to provide support to the MAF, develop sub-contractors and create off-shoots such as Ikramatik.[107] According to Mr. Wan Shahruddin, the CEO of Sapura Defence:

The simulation offsets venture had several benefits to our company. We were able to gain access to restricted technology, venture into new business and diversify into civil sectors. These achievements were in-line with government aspirations and commitment towards economic development and self-reliance. [108]

MMC Defence claims to have benefited from improved management techniques through the technology transfer process.[109] For example, the transfer of technology for the design and manufacturing of the stowing kits for JERNAS short-range missiles enhanced MMC management techniques across several areas, including documentation and quality assurance procedures by the MMC Defence workers.[110]

As defence and aerospace processes involve high levels of security and safety, these industries must develop stringent step-by-step documentation to ensure accuracy in final production. Local managers and staff are trained by the OEMs to establish good quality documentation with appropriate control mechanisms to ensure high quality production. Local firms will not be able to participate in offsets production unless they have complied with the OEMs' stringent expectations regarding quality assurance processes. Several Malaysian firms have successfully been accepted into the OEMs' supply chain to produce parts and components mainly for civil customers.

Table 5.22, below shows that, 12 of the 16 respondents claim to have established equal capabilities with other regional countries in manufacturing processes, assembly and MRO. These are mainly first-level manufacturing processes, safety and maintenance, and through-life support activities. Some of these companies, such as Airod and Zetro, have used their know-how to penetrate the regional market by servicing commercial and military aircraft across the world. Malaysia's aspiration of becoming a capable regional service centre is threatened by the increasing cost of skilled labour, the high attrition rate of skilled workers within the MRO sector and competition from other neighbouring countries trying to penetrate into emerging markets, such as the Philippines and Thailand. Malaysian defence firms are still highly dependent on the government for marketing support, seeing offsets as a means of encouraging more offshore suppliers to use local companies for in-country and regional activities. However, only one out of the four companies that responded claim to have capabilities in product design and quality to compete regionally or internationally. More than 50% of the respondents were unsure of their company's capability in terms of product design and quality and therefore did not want to respond to the question.

Overall, Table 5.22 indicates that Malaysian companies have limited capabilities to compete internationally in product design, safety and management strategy pertaining to defence technology. These companies, however, do have capabilities in manufacturing processes, assembly, MRO processes and through-life support to compete regionally.

Table 5.23 shows that the strengths of Malaysian defence companies are based on favourable costs of skilled workers (50%) and product and process technology (31%). None of these companies have built their competitiveness on marketing strategy, to independently innovate and push exports internationally. Globalisation pressures have forced the government to encourage partnership in the form of regional service centres, such as the case of Eurocopter Malaysia in Subang and also the formation of the Agusta-Westland Service Centre. The formation of in-country service centres have existed from the 2001 FENNEC offsets programme, with the 2003 LOH offsets programme also aimed at promoting local partnerships.[111] partnership basis, where genuine transfer of technology must happen instead of the ‘fly by night’ MNC model of continuously looking for the cheapest cost centre. [112]

Table 5.22 : Benchmarking Local Defence Technology Capabilities

Question 2.06: For each of the following categories, please rate your company's position versus competitors	Behind other local companies	Similar to other companies	Equal to the best in the region	Equal to the best in the world	Total number responded
Product design and quality	-	4	1	1	6
Manufacturing process	-	3	12	1	16
Assembly	-	2	12	2	16
MRO process	-	3	12	1	16
Through-life support	2	7	7	-	16
Systems integration	-	5	8	3	16
Safety	-	7	7	2	16
Management strategy	-	7	9	-	16

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2005.

Based on local firm capability, these facilities will eventually become fully-owned Malaysian companies. This initiative is also seen as an effective option by the government to assist the local defence industry in attaining competitiveness without huge capital investment in the short-run. However, this arrangement is expected to be on a *win-win* long-term.

Table 5.23 : Malaysian Industry Competitiveness

Question 2.07:Your Company's Competitive Strategy in its Principal Business is based on:	Total (%)
Natural resources availability	6
Favourable costs of skilled workers	50
Product or process technology	31
Marketing strategy	-
Infrastructure support	13

Source: Malaysia Survey of Offsets Recipient Firms, 30 March-31 July 2005.

5.5.2 Dual-Use Technology

Table 5.24 indicates that 69% of respondents claim that they were not able to utilise the technology transferred through offsets for civil-related projects.

Table 5.24 : Dual-Use Technology

Question 5.08	Yes (%)	No (%)
Ability to use the technology gained for dual-use application, mainly civil related projects	31	69

Source: Malaysia Survey of Offsets Recipient Firms, 30 March-31 July 2007.

As discussed in Chapter 4**,** most of the defence firms in Malaysia are dual-use, or civil companies with a defence arm, carrying-out defence-based work. Some 70% of these companies are able to switch their operations easily from defence to civil work.[113] In such instances, the most viable option will be for these companies to venture into technology fields which are of a dual-use nature. However, the survey results show that 69% of respondents felt that offsets-related technologies were not dual-use. The few areas where dual-use technologies have proved applicable include inventory management, software (especially asset management), parts issuance or orders, imaging technology, where technology captured images have improved drastically and the management of natural resources, such as raw materials and urban development.

Respondents claim that workers in their companies are able to apply to civil work the ‘know-how’ in relation to documentation and management procedures gained through the military technology process. For example, UPECA was able to enhance its manufacturing processes in the usage of CNC machines. Sapura Defence improved its visual system for marine, automotive and aerospace application. DEFTECH enhanced its automotive design and assembly capabilities for application in civil work. Table 5.25 reinforces this point, with 69% of the respondents agreeing that technology obtained through offsets has narrow applicability solely to the defence systems produced by the companies.

Table 5.25 : Applicability of Technology Received through Offsets

Question 4.05(ii)	**Yes (%)**	**No (%)**
Does the technology have narrow applicability to defence systems produced by the company?	69	31

Source: Malaysia Survey of Offsets Recipient Firms, 30 April-31 July 2005.

SMET’s premises, for example, were not utilised when the production of the Styer rifles was stopped. This is because the machines and equipment in the premises were not dual-use. SMEA took over the operations and tried to utilise the machines but later gave-up the idea, realising the cost was too high to maintain the equipment, and the machines could not be used for any other type of production aside from weapons. Similarly, DEFTECH abandoned the jigs and tools that were made during the 2000 ACV project, as these tools could not be used for civil projects. On the whole, the dual-use technology transfer has been more applicable towards enhancing know-how or tacit knowledge amongst managers and workers as opposed to supplying dual-use facilities, tools and machinery.

5.9.3 Diversification

Technology obtained through offsets has been utilised by recipient companies to diversify into other projects. For example, the 1992 Hawk offsets project was used to develop the MD3, a two-seater light-weight trainer aircraft. This was a partnership between BAE Systems, SMEA and SME Aviation. Another example is the Unmanned Aerial Reconnaissance (UAV) commercial aircraft development programme between BAE Systems, CTRM, SCS, Excelnet and Ikramatik. Three aircraft have so far been produced and sold to the Malaysian Armed Forces. Technology obtained by these companies involved in the two projects has been used in design and development of other defence and civil aircraft. SMEA and CTRM, for example, have utilised the technologies to manufacture parts and components for the Airbus aircraft series. Excelnet has also been able to utilise the expertise obtained from the design to venture into other projects.[114] In the case of CTRM, offsets were used to diversify into civil projects. The composite technology obtained through the Eagle Aircraft project was used to develop skilled engineers, management capabilities and design and manufacturing capabilities. This advantage was used by CTRM to diversify into civil aerospace composite manufacturing projects, such as the A320 (design approval), NIMROD, A380 and most recently the A400M series. The company has gone a step further by investing in R&D for composite manufacturing.[115]

5.9.4 Market Penetration

Technological learning is at the highest stage when a firm is able to design a new product or process and penetrate a foreign market. For Malaysia, offsets have not been successful in assisting Malaysian companies to penetrate into new markets, as shown in Table 5.26.

Table 5.26 : Market Penetration

Question 5.09	Yes (%)	No (%)
Indicate the benefits of offsets with respect to market penetration	25	75

Source: Malaysian Survey of Offsets Recipient Firms, 30 April-31 July 2005.

Table 5.26 shows that 75% of recipient companies indicate that offsets have not equipped them with the capabilities to produce for the export market.[116] Some collaborative projects have been able to explore products overseas, including those between IKramatik, CTRM and Excelnet to develop and market the commercial UAV.[117] UPECA Engineering has also been able to use its aerospace manufacturing accreditation certification, gained from a BAE systems offsets project, to penetrate the US and UK markets (Honeywell and Weston Aerospace) respectively.[118] Many of the Malaysian companies rely heavily on the MOD for business and marketing. The government, for example, was heavily involved in trying to market the UAV aircraft through the defence industry Bilateral Agenda to countries and regions such as Vietnam, Brunei and the Middle East. One offshore supplier highlighted the reluctance of Malaysian firms to invest into marketing. OEMs view offsets as a *gate-opener* to promote technology partnerships with local companies but access does not come free. Local companies are expected to also invest in the marketing of their products.[119]

5.9.5 Defence Exports

Offsets have had minimal impact on Malaysian defence exports. Referring to the offsets objectives in Chapter 4, whilst Malaysia emphasised skill-generation, the policy did not focus on the ability of Malaysian companies to export the process, product or services. Commercialisation of technology has been completely neglected, but there is now a drive by the local defence firms to build export capabilities. However, many of these companies still depend on government assistance both due to the lack of resources and the huge investments involved in defence R&D. As previously stated, 90% of survey respondents indicated that offsets have not created export opportunities for their companies.[120] There was only one project that incorporated BOT in Malaysia's offsets projects which tied the defence contractor conmcerned to secure export for the local supplier. Supplier companies interviewed agreed to such ventures, depending on the attractiveness of the offsets policy, including higher multipliers. One supplier mentioned that:

Why should we have BOT or buy back arrangements when we can have similar arrangements with many other countries around the world. What is that Malaysia can do to lure us? We need good incentives, like high multipliers to be able to do work with your companies.[121]

By contrast, civil work obtained through offsets has created more exports for Malaysia. SMEA, for example, a defence and aerospace company has enjoyed growth in export sales from 3% in 2000 to 30% in 2004.[122] This sudden increase in business is primarily due to defence offsets being used for civil aerospace projects, involving the manufacture of metal parts and components. SMEA's CEO, Rtd Colonel Chee Ng Boon stated that :

Our company uses offsets as a gate-opener to get new business. We now do not have to rely on offsets, as the company has built its technological and industrial capability to be equally competitive in the market. Now, all our contracts are based on competitive tendering, taking into account price, quality and on-time-delivery. [123]

This confirms the research finding that defence offsets used for civil projects are more successful in equipping Malaysian firms with the 'technology' for both indigenisation and export.

5.9.6 Job Creation

Despite the hype about offsets-induced job creation, the actual number of new Malaysian jobs created has been minimal. In total, between the years 2000-2004, the 16 recipient companies state that only 95 additional jobs in total were created from offsets projects.[124] Most of these jobs were low-end, not high-end, technology work. This is evidenced by the linked research findings that the offsets programmes had concentrated on basic training and maintenance for through-life support of the defence equipment purchased.

A small number of jobs were created in software development, hardware networking, CAD usage, CNC machining and welding. However, the CAD jobs were undertaken by foreign workers, mainly from India and Indonesia, with few locals being trained.[125] Some of the local companies also face problems in terms of sourcing of workers in the usage of CNC 5 axis machines. A few technical schools in Malaysia do provide education in these areas but not hands-on training in the usage of such machines. These employees have to be trained in-house by the local firms upon recruitment. [126]

Eurocopter Malaysia, a wholly owned subsidiary of EADS, was spawned from the FENNEC offsets project.[127] The company, realising the need for local expertise in aircraft maintenance, conducted several programmes to train locals. The partnership programme with the Malaysian Institute of Aviation Technology (MIAT), for example, is committed towards training 100 apprentices over a 5 year period.[128] The nature of such programmes is to train locals to undertake more substantial high-end work, eventually replacing overseas experts within the industry.[129]

Overall, it has been difficult for local firms to sustain defence sector jobs as most of the offsets projects have unavoidably proven to be 'one-offs'. Several firms had to abandon their defence facilities and convert them to civil-use after completion of the offsets projects. This raises the policy question as to whether Malaysia should focus on high-technology jobs involving less workers, like the RM 5million tantalum project in Kulim Technology Park employing 50 workers, or should offsets policy focus on areas such as fishing, and agriculture, potentially creating more sustainable long-term jobs. [130]

5.9.7 Skills Enhancement

In terms of skills enhancement, offsets have proved successful in the operational and maintenance field. Whilst progress has been made, offsets policy needs to evolve to calibrate with Malaysia's industrial shift from labour-intensive to capital-based industry. Offsets have successfully enhanced local defence manpower skills especially in areas that require documentation, quality assurance and systematic work processes, complying with international standards and requirements. Some 85% of the questionnaire respondents state that offsets have been successful in improving worker skills.[131] For example, rigorous quality and process control requirements involved in the aerospace industry have been beneficial for Malaysian workers, enforcing high quality international level competitiveness.

5.5.8 Sub-Contracting and the Promotion of Industrial Clusters

Some 63% of respondents agree that offsets have strengthened the local sub-contractor base. In the Hawk aircraft offsets deal, for example, BAE Systems placed sub-contracting work worth £92,000,000 in areas such as pylon manufacture, ground-support equipment (GSE) manufacturing, replacement of tyres and the manufacturing of wire looms.[132] In the 2002 JERNAS offsets contract, MBDA sub-contracted several work packages for vehicle installation kits and stowed-equipment to SMEA and MMC Defence. This included portabar assembly and the spreader sling multiple leg, skid, hub-assembly, jockey wheel and parts of the heavy lift trolley.

Major sub-contracting work was allocated to PSCNDSB under the Patrol Vessel (PV) project. Yet, despite the government's aspiration that several hundred sub-contractors would materialise, this has not happened. A special PV offsets committee was set-up by the MOF to monitor the progress of this project. The overall project was deemed a failure, and PSCNDSB had to finally hand-back operational control to the government. There were several reasons for project failure. Firstly, PSCNDSB was not efficient in farming-out the contracts to deserving sub-contractors. Several sources also claimed that smaller companies were charged to participate as sub-contractors and this complicated matters.[133] Other reasons included inefficient project management by PSC. Overall, the government was disappointed with the outcome of this offsets project, supposedly the pioneer project to operationalise aspirations to strengthen backward linkages in the defence sector. It was a bitter experience for the Armed Forces, keen to ensure delivery of timely top-quality equipment to budget.

Defence offsets have proved more successful in fostering sub-contractorisation and backward linkages in the civil sector, as opposed to the defence sector. In particular, foreign prime contractors have used offsets to integrate Malaysian companies into their global supply chain. It should be recognised that companies, such as SMEA, have been successful in obtaining significant subcontract work through offsets. SMEA has developed capabilities to manufacture weapon pylons for Hawk aircraft and ground support equipment. Capability obtained through technology transfer later provided SMEA with business opportunities to become a third tier sub-system (equipment) supplier within the OEM's global supply chain. SMEA has currently positioned itself as a sub-contractor for the Airbus series and A400M, supplying metal parts and components within EADS's international supply chain. According to SMEA's CEO, offsets are no longer required to secure work as the company has acquired capabilities to compete internationally on a level playing field.[134]

BAE Systems provides an even better example of subcontract success though offsets. Over the last 15 years, BAE Systems has placed work with at least four Malaysian defence prime contractor companies worth RM 608,300,000.[135] The subcontracts covered several areas, including, manufacturing of metal and composite parts and components, pylon loom manufacturing, as well as design work. As shown in Table 5.27, much of the work was placed with Malaysian aerospace companies, such as CTRM, SMEA, ACT (subsidiary of CTRM) and Excelnet.

This sub-contractoring work has been successful in creating backward linkages. The local prime contractors subcontract some of the OEMs' work to other smaller companies; the latter are normally located in the same industrial area, creating clusters of industries. Significantly, this subcontract work is not defence-specific and therefore existing civil companies can undertake the jobs. SMEA, for instance, sub-contracted work to UPECA Engineering, acting as a fourth-tier manufacturer of machined mechanical components.[136] As a consequence, UPECA, based in Puchong, Selangor, has increased its turnover from RM16million in 1992 to RM 22 million in 2004.[137] The company produces parts and components for SMEA.

Through this work, UPECA has also enjoyed improvements in process control, internal quality processes and manpower skills in CNC machining.[138] UPECA is presently upgrading its product line through the know-how gained from offset-derived subcontracts. This is allowing the company to bid for high-end customers through quality awards and certification gained from companies, such as BAE, Airbus and Honeywell. UPECA has also managed to use these benefits to create spin-offs in safety and quality measures for the oil and gas industry sector.[139] Finally, UPECA has fostered local sub-contractors in secondary processing, such as surface treatment.[140] Such modest beginnings nevertheless create industrial foundations for technological progress.

Table 5.27: Malaysian Prime Contractors Offsets Projects Sourced from BAE Systems, UK (1992- 2005)

Company	Work Placed
SME Aerospace	Airbus(single aisle) machined details Avro RJ leading edges Avro RJ leading edge and carriage assemblies A380 manufacture of components RAF Hawk tank floor, ceiling and frame 13 Airbus A320 (single aisle) machined assemblies Airbus A320D Nose sub-assemblies RAF Nimrod Sonobuoy rack assemblies RMAF/South Africa /Australian pylon manufacture Bulldog modification kits Jernas detail machining
ACT	Airbus A300 fixed trailing edges Airbus A320 (single aisle) leading edge and trailing edge panels Airbus A320 (single aisle) aileron mod package
Airod	Mk 67 centreline pylon looms RMAF pylon loom manufacture
Excelnet	Nimrod Sonobuoy design package Nimrod airstairs design work
CTRM	A380 manufacture of components

Source: BAE Systems, August 2005.

SMEA, as a prime contractor company in Malaysia, has contributed to the strengthening of backward linkages. SMEA's work is distributed to 12 subcontractors located in Selangor. These companies are civil companies located within the same industrial area as SMEA, and supporting SMEA's work in the manufacturing of tools, drill jigs, mix fixtures and sub-assembly jigs. Additionally, Ikramatik, an ICT company, reported that it had created sub-contracting work in areas such as wiring, lighting-generators, painting, mechanical and electronic parts, and computer projects in 2004, worth RM 1.2.million.[141] Zetro Aerospace subcontracted work worth RM 18 million to 27 Malaysian companies in areas such as UPS and lighting protecting systems.[142] Importantly, Eurocopter Malaysia has created 20 subcontractors, providing work worth RM17.5 million between years 2002-2004.[143] The above examples indicate that the bulk of these sub-subcontracting projects have been in the civil aerospace and electronics sectors, as opposed to defence. Except for some design-related work, many of the subcontracts have initially at least been at a low-level, mainly metal-bashing and 'build-to-print' subcontracting work.

5.10 Offsets and Transformational Costs

Technology transformational costs might arise due to the lack of policy transparency, unrealistic demands from the host country and a lack of recipient capability. The government's role is vital to ensure that these factors are addressed, bringing down the cost.

This study's fieldwork found that offsets do cost money. The finding indicates that a cost premium averages between 4-15%.[144] This premium includes the:

i. Direct cost of operations, without margins, plus the value of the technology (if any).
ii. Direct costs of manufacturing, purchase, training and non-recurring costs (such as capital investments, surveys, qualifications, quality assurance, technical assistance), administrative costs, technical supervision, quality process, capital investment, technical assistance and progress monitoring.

iii. Indirect costs, such as licenses, loss of income, royalties, intellectual property rights and risk.[145]

Offshore vendors impose a higher price tag on technologies transferred through offsets as these technologies are not supposed to be available off-the-shelf. However, in the case of Malaysia, Table 5.28 shows that 80% of respondents confirm that technology obtained through offsets is readily available from several other sources in the world and are not particularly sophisticated or highly sensitive. The issue is whether Malaysia needs to pay a higher price through offsets to obtain technology that could have been obtained from open sources at a lower cost.

Table 5.28: Causality

Question 4.05(i)	**Yes (%)**	**No (%)**
Is the technology readily available from other sources in the world?	80	20

Source: Malaysia Survey of Offsets Recipient Firms (July 2005)

Greater transparency of offsets requirements such as process, implementation and monitoring could reduce offsets costs. If offsets requirements are raised late in the contract negotiations, then this forces suppliers to raise premiums due to unforeseen circumstances leading to non-fulfilment of obligations. Direct offsets projects, moreover, cost more as there is a higher risk of non-recurring 'one-offs', a higher outlay of capital investment, with longer ROI, and a greater risk of non-sustainable projects.

On the other hand, indirect offsets projects, especially those incorporating dual-use technologies, incur less offsets-related costs as suppliers view these projects as sustainable, with long-term impacts on technology, human resource development and civil-military integration. Short-term projects involving basic training and technical know-how with minimal commercial value, increases the costs of offsets. This is because suppliers view training as 'one-off' activities not necessarily guaranteeing commercial viability. Potential multiplier effects from offsets projects are viewed with even greater suspicion by suppliers. Further, if the technology transfer requested involves high levels of export control clearance in the supplier country, then this will also increase the costs of offsets. [146]

Offsets costs could be reduced if the offsets management policy and processes are more transparent, if offsets projects are not short-term but rather are driven by long-term 'commercial' partnerships, and, finally, if the choice of offsets projects are realistic and pragmatic.

5.11 Challenges to Sustainable Partnerships

Defence industrial sustainability demands repeat orders. Malaysia has experience of offsets projects failing because of lack of repetitive orders. The first example has regard to the 2002 purchase of modular suspension bridges for the Malaysian Army from BAE Land (Vickers-Bridging at the time). The offsets requirement was for technology transfer to CTRM enabling it to supply carbon composite launch rails for the modular suspension composite bridges. CTRM already possessed skilled composite technology workers and secured the offsets contract (worth 12% of the primary defence contract value or $2, 936,316) to build the composite rails for BAE Land.[147] Technology transfer involved the training of local workers, as the rails were build-to-print. Polymeric Ltd, the Vickers UK subcontractor of launch rails was invited to Malaysia to provide the training of local workers. The cost of this training was claimed to be £50,000, and a further £750,000 was spent on the jigs and fixtures required for the CTRM site.[148] However, after having developed the infrastructure and the training of workers, CTRM failed to secure any fresh orders. BAE was willing to provide CTRM with work if it managed to secure new contracts from South Korea or if the Malaysian government were to buy more of this system, but further contracts failed to materialise. The problem for CTRM was that it lost its capabilities as no further orders arose.[149] CTRM has recently shut down its composite rail manufacturing facilities, transferring all workers to another site. [150]

A second example relates to the Malaysian defence automotive company, DEFTECH, which secured an offsets project from Malaysia's ACV 300 armoured personnel carriers. DEFTECH secured work to manufacture parts and components for the vehicles, installation of vehicle sub-systems, as well as assembly and maintenance. According to the agreement, 146 vehicles were completed in Turkey, with a further 65 built in Malaysia.[151] This involved complete-knock-down (CKD) versions of the vehicles which were assembled at the DEFTECH plant in Pekan, Pahang. However, upon project completion, the plant in Pekan was abandoned. The question is whether the RM 50 million investment for infrastructure and equipment, as well as the RM 12 million for the test track, was cost-effective, given that no new work was available.[152] DEFTECH later diversified into manufacturing multi-purpose vehicles. The plant in Pekan was utilised to manufacture multi-purpose vehicles, such as buses, fire-engines and other vehicles. DEFTECH has been successful in exporting these vehicles to Bangladesh, Brunei and Timor Leste.[153] The company realised that diversification into civil work was a more viable option than attempting to sustain its defence business in the long-run. However, most of the jigs and tools that were used in ACV production were left unused.

A third example of offsets business vulnerability is Sapura Defence. Although Sapura has been successful in the indigenisation of technology through simulator development, the company continues to face several critical challenges which could lead to the loss. The loss of in-house expertise if there is no new business. The challenge of maintaining innovation in this area is great, requiring R&D investment but facing the reluctance of OEMs to share state-of-the-art technology. The company is only able to continue with defence activities if it obtains further business either from the government or through exports. Currently, Sapura does not receive any form of government R&D support grants to retain or enhance its capability in this field.

These examples demonstrate that three major Malaysian defence companies have not been able to sustain defence work due to lack of market demand, either locally or foreign. Offsets, for these companies, have been more a 'one-off' phenomenon. Interestingly, all three companies have relied on civil projects to sustain their business.

5.12 Summary

This chapter has analysed the policy formulation, strategy and implementation of defence offsets in Malaysia. The Malaysian government has been instrumental in operationalising defence offsets policy as well as ensuring the effectiveness of this tool. In Malaysia, offsets have had both positive and negative impacts on the development of its defence industrial base. Considering the internal and external factors that have influenced Malaysia's defence industries, offsets have managed to create innovation, skills, jobs and also subcontracting and diversification into civil projects. However, the extent of the impact on these activities has been limited.

Notes and References

[1] Opening speech by Dato' Dr. Mahathir Mohamed at the LIMA 01' show in Langkawi, December 2001.

[2] Malaysia has ascended to 26th rank in this year's World Competitiveness Scoreboard (world competitiveness centre). See World Competitive Scoreboard, *World Competitiveness Yeabook*, [online], (The Global Meeting Place for Executive Learning, Washington, 2006), (Accessed: October 2006), Available via: http://www02.imd.ch/wcc/countrylist/

[3] Malaysia. Economic Planning Unit, *8 Malaysia Plan (2001-2005)*, (Prime Minister's Department, Government Printers, Kuala Lumpur, 2001).

[4] A list of countertrade activities carried out with overseas countries in the initial stages is as per Appendix 1.

[5] The committee consisted of members from the Ministry of Defence, Malaysia, Ministry of International Trade and Industry (MITI), Ministry of Science, Technology and Environment (MOSTE), Ministry of Enterpreneur Development, Economic Planning Unit, SIRIM and MIGHT. Information obtained from the MIGHT Report, See: Malaysia. Malaysian Industry Government Group for High Technology (MIGHT), *A Study on Offsets Programme of the National Defence Procurement*, (Prime Minister's Department, Putra Jaya, November, 2001), (restricted).

[6] Interview with Mr. Jesbil Singh, former Under Secretary , Defence Industry Division, who was involved in the government offsets negotiations from 2001-2005. He claimed that the lack of expertise on offsets matters amongst offsets desk officers was also an advantage to the suppliers.

[7] MIGHT, *Profile,* [online], (MIGHT, Putra Jaya, 2007), (Accessed: 11 February 2007), Available via: www.might.org.my.

[8] This MIGHT report details the benefits accrued by Malaysia through offsets, challenges faced by local companies and some suggestions on how to increase the effectiveness of the offsets tool. For further details see: Malaysia. Malaysian Industry Government Group for High Technology (MIGHT), *A Study on Offsets Programme of the National Defence Procurement*, (Prime Minister's Department, Putra Jaya, November, 2001), (restricted).

[9] Ibid.

[10] Officers were sent to the ARMSCOR and Denel Pty Ltd, South Africa and to DESO as well as MBDA and BAE Systems in the United Kingdom to learn about their offsets practices.

[11] Malaysia. Ministryof International Trade and Industry (MITI), *MITI Report*, (Bilateral and Regional Division, MITI, Kuala Lumpur, September 2004).

[12] See Malaysia. Malaysian Industry Government Group for High Technology (MIGHT), *A Study on Offsets Programme of the National Defence Procurement*, (Prime Minister's Department, Putra Jaya, November, 2001), (restricted).

[13] The other members of the meeting included the Ministry of Finance and the six other ministries implementing offsets which include MINDEF, Ministry of Home Affairs, Health, Education, Transport and Works.

[14] Interview with Mr. Jesbil Singh, Under Secretary, Defence Industry Division, Ministry of Defence, Malaysia,(2002- February 2005), July 2005.

[15] Kechil, Hadi Awang, Malaysia's Offsets Policy, *In: 06 International Offsets Conference, Subang, 8-11 April 2006*, (DSA 2006, Kuala Lumpur, 2006).

[16] MOF, which oversees all offsets policy matters, is also looking at the possibility of extending the defence offsets policy to the five other ministries.

[17] Ministry of Defence, Malaysia (MOD), *Malaysian Defence Industry Council*, [online], (MOD, Kuala Lumpur, 2006), (Accessed: 12 November 2006), Available via: http://www.mdic.gov.my.

[18] MIGHT conducted a survey on 70 companies which were offsets recipients from 1990-2000. Some 32 companies responded giving a sample size of 45%. These were offsets recipients from both defence and non-defence sectors. The findings were reported to the stakeholders chaired by the Economic Planning Unit, Malaysia in 2001.

[19] This issue was debated at the Defence Industry Blueprint Workshop held in Port Dickson, Malaysia May 2005. The members of the MDIC and MOD, Malaysia, were critical of the fact that defence industry was not given sufficient weightage within the IMP3 but was clustered together under the broader category of general industries. An interview was also conducted with the MITI representative in May 2005 regarding this matter.

[20] Feedback obtained through an interview with a defence related automotive industry executive Malaysia, May 2005.

[21] Interview with a Mr. Juan Manual Garcia, Navantia office, Madrid, Spain April 2006.

[22] Telephone interview with Col (Rtd) Andrew , MMC Defence, Malaysia, August 2006.

[23] Several recommendations were made to the government by various consultants and MIGHT recommending the formation of an offsets project team, but as part of the main procurement project team. This has yet to formalize. Currently, DID is invited to conduct all negotiations pertaining to offsets and the exercise is carried out separately.

[24] Interview with Colonel Hanafiah, Offsets Unit, Defence Industry Division, MOD Malaysia, June 2005.

[25] Information obtained through interviews with offsets recipient companies, May-July 2005, Malaysia.

[26] The MINDEF Procurement Division has seven units. These units respectively are responsible for the different services purchases. Unit one is responsible for Army purchases; Unit 2 for navy; Unit 3 for Air Force: Unit 4 for Communication and ICT; Unit 5 for Common-User items; Unit 6 for R&D; and Unit 7 is for all administration work.

[27] Interview with OEM executive during the fieldwork, April- July 2005.

[28] This issue was also raised in the Report prepared by Johan van Dyk of Denel Pty Ltd for the government of Malaysia. The Report titled *The Countertrade Gap Analysis* dated September 2002 was prepared and presented to the MOD, Malaysia. This was part of an offsets obligation by DENEL for the purchase of the G5-155mm gun by the Malaysian Army. See Malaysia. Johan Van Dyk, *Malaysian Countertrade Gap Analysis Report*, (Denel Pty Ltd, South Africa, September 2002).

[29] In the past, there have been no set rules or guidelines to specify the percentage of offsets.

[30] Interview with Colonel Hanafiah, Defence Industry Division, MOD Malaysia, June 2005.

[31] Malaysian Procurement contracts from 1992- 2005, Ministry of Defence, Malaysia, April-July 2005.

[32] Malaysia. Economic Planning Unit, *Forward Note, Abdullah Ahmad Badawi, Forward, 5 Year Malaysia Plan (2005-2010),* (Government Printers, Kuala Lumpur, 2006).

[33] Study of the contract documents during fieldwork at Ministry of Defence, Malaysia, April- July 2005.

[34] Mary Bell of DESO, UK, during her attachment with MOD to study the Malaysian offsets, recommended that MOD look into implementation, especially the monitoring whereby a computerised system or some sort of a systematic approach be taken to capture and monitor offsets progress. Report to Secretary General, Ministry of Defence, Malaysia, June 2002.

[35] Interview with Mr. Wan Saupee, Offsets Monitoring officer at the Defence Industry Division, MOD Malaysia, June 2005.

[36] Interview with a defence contractor during fieldwork survey, May 2005.

[37] Interview with Mr. Simon Edge, Industrial Participation and Offsets Manager, and Brian J Mc Eachen, General Commercial Manager, Westland helicopters (now Agusta Westland), Yeovil, 24 March 2005.

[38] Interview with Mr. Joe Flaherty, Boeing Offsets Manager, United States, June 2005.

[39] Malaysia. Malaysian Industry Government Group for High Technology (MIGHT), *A Study on Offsets Programme of the National Defence Procurement*, (Prime Minister's Department, Putra Jaya, November, 2001), (restricted).

[40] Sourced obtained from the Ministry of Defence, Malaysia, June 2005.

[41] For further discussion on this issue, refer to Kogila Balakrishnan, Malaysian Defence Industrialisation through Offsets, In: *05 International Conference inDefence Technology, Petalaing Jaya, 11-13 December,2005*,(Military Academy, Malaysia, Marriott Hotel, Petaling Jaya, Malaysia, 2005).

[42] Data obtained from the Defence Industry Division, MINDEF, Malaysia, June 2005.

[43] Information obtained from MOD, Malaysia where official contract documents specify types of offsets projects.

[44] Information gathered during fieldwork in Malaysia, June 2005.

[45] Interview with Dr. Ghaffar Ramli, Director of STRIDE, MOD Malaysia, during fieldwork research June 2006.

[46] Some 90% of the OEMs interviewed agreed that they would rather offer indirect non-defence offsets as opposed to defence related offsets. Information obtained from fieldwork survey, May-July 2005.

[47] Survey results obtained from questionnaire during fieldwork, April-July 2005.

[48] Information obtained from fieldwork survey, Malaysia, May-July 2005.

[49] Survey results obtained from questionnaire during fieldwork, Malaysia, April-July 2005.

[50] Interview with Mr. John MacBeath and Mr. Steve Jackman of BAE Systems, Farnborough, UK, March 2006.

[51] Information obtained through interviews with various defence suppliers with offsets obligations in Malaysia, April-July 2005, fieldwork in Malaysia.

[52] Interview with an Armed Forces representatives involved in logistics support from the MOD Malaysia, Malaysia fieldwork survey, June 2005.

[53] Interview with Malaysian company representative during Malaysia fieldwork survey, July 2005.

[54] Interview with defence contractor, Malaysia fieldwork survey, June 2005.

[55] Interview with Major Ismail, Offsets desk officer, MOF, Malaysia , Fieldwork in Malaysia, April 2006.

[56] Interview with Major Ismail, Offsets desk officer, Malaysia. Fieldwork in Malaysia, April 2006

[57] A common feeling expressed by the majority of the OEMs and local companies is that the government's decision to formalise the offsets policy was welcomed as a positive development.

[58] This issue was raised at the MDIC meeting. Minutes of the meeting, Mariott Putra Jaya, Malaysia, 14 June 2001. See also Malaysia. Malaysian Industry Government Group for High Technology (MIGHT), *A Study on Offsets Programme of the National Defence Procurement*, (Prime Minister's Department, Putra Jaya, November, 2001), (restricted).

[59] Lt Colonel Ir Kamarulzaman Zainal, Technology Depository Agency, *In: 05 Making Offsets Work Workshop, Menara Kuala Lumpur, 7 July, 2005*, (Ministry of Defence, Malaysia and Cranfield University, 2005).

[60] The final approval by MOF to formalise this fund was announced at the MDIC meeting on 12 September Zetro Aerospace Complex, KLIA, Sepang. Refer to minutes of the MDIC Meeting, Malaysia, p. 14.

[61] At an MDIC meeting chaired by the Minister of Defence, a decision was made that the MOD Malaysia with input from the relevant government agencies, defence think-tanks and Malaysian industry would formulate a defence industry blue-print. Malaysia fieldwork, June 2005.

[62] Two workshops were held to discuss the contents of the blueprint on 10-12 October 2002 and June 2005 at the Regency Hotel and Resort, Port Dickson. The input towards the formulation of the blueprint came from government as well as Malaysian industry members. The author was present at both these workshops.

[63] Procurement Division, Ministry of Defence, Malaysia, August 2006.

[64] Interview with Lt Colonel Kamarulzaman and Major Zailani of MIGHT at the MIGHT office, Prime Minister's Department, Putra Jaya, Kuala Lumpur, fieldwork in Malaysia, May 2005.

[65] Information obtained during interview with Lt. Colonel Kamaraulzaman and Major Zailani, MIGHT office, Prime Minister's Department, Putra Jaya, Malaysia, 5 May 2005. Fieldwork in Malaysia.

[66] Data obtained through fieldwork survey and observation during fieldwork, 30 April-31July 2005.

[67] Information obtained from fieldwork questionnaire survey, Malaysia, 30 April-31July 2005.

[68] Information obtained from MOD, Malaysia , interview with representatives of offsets recipient companies and researcher's observations, 30 April-31 July 2005.

[69] Defence Industry Division, MOD Malaysia, 30 April- 31 July 2005.

[70] Second and third level MRO may differ between the air, sea and land equipments.

[71] Op cit, 30 April-31 July, 2007.

[72] Interview with Colonel (Rtd) Narinder Singh, DEFTECH plant, Shah Alam, Selangor. Fieldwork in Malaysia, May 2005.

[73] Interview with Colonel (Rtd) Ahda, MMC Engineering, Nilai, Pahang. Fieldwork in Malaysia, June 2005.

[74] Procurement contract documents, Defence Industry Division, Ministry of Defence, Malaysia, June 2005.

[75] Ibid. June, 2005.

[76] Interview with Dr. Assanah, Caidmark, Damansara Jaya, Kuala Lumpur, Malaysia, May 2005.

[77] Astronautics Tech (M) is a 100% government owned company.

[78] Interview with Mr. Ng Ewe Jin, UPECA Engineering, Kuala Lumpur, May 2005 and also with Mr. Richard McKie, BAE, Farnborough, February, 2006.

[79] According to Mr. Chee Ng Boon, CEO of SMEA, local firms claim that although China has become a major manufacturing competitor with very competitive labour rates, Malaysia is competing in terms of high capital-intensive and not labour-intensive skilled workers. Fieldwork in Malaysia, June 2005.

[80] Interview with offsets manager at a Malaysian defence based aerospace company, Fieldwork research, June 2005.

[81] Author's findings through scrutinisation of Offsets Contracts from 1992-2004, Ministry of Defence, Malaysia. Fieldwork survey in Malaysia, 30 April-31 July 2005.

[82] Author's observation and interviews during fieldwork survey in Malaysia, April- July 2005.

[83] Interview with Col (Rtd) Kamaruddin Kamarulzaman, Zetro Aerospace Corporation Sdn Bhd, during fieldwork in Malaysia, June 05.

[84] Interview with MOD officer. Fieldwork survey in Malaysia, 30 April-31 July 2005.

[85] Telephone interview with Ms Khalijah Ahmad, R&D officer, STRIDE, Kajang, Malaysia, 7 February 2007.

[86] Interview with Mr. Zainal at the Automotive Industry Section, Malaysian Industrial Development Authority (MIDA). Fieldwork survey in Malaysia, May 2005.

[87] This issue was discussed by an officer at the Procurement Division, MINDEF Malaysia, who was involved directly in managing the problem as well as by industry representative from ZETRO Aerospace, Colonel (Rtd) Karamarulzaman. Fieldwork in Malaysia, June 2005.

[88] Interview with supplier during fieldwork in Malaysia, June 2005.

[89] Information gathered through interviews with defence suppliers. Refer to question 3.13 and question 3.15 (OEM questionnaire).

[90] Questionnaire reply from Mr. Philippe Macchetti, Armaris (previously known as DCN International), France, July 2006.

[91] Interview with Tuan Syed M.Jamil, Ikramatik, Glenmarie Industrial park, Shah Alam during fieldwork in Malaysia, 30 April-31 July 2005.

[92] Telephone interview with Colonel Andrew, MMC Defence, Nilai, Seremban. September, 2005.

[93] Author's observation and interview with Alvis workers and CTRM workers during site visit to CTRM, Malacca, June 2005.

[94] Interview with Colonel (Rtd) Narinder, DEFTECH at the DEFTECH premises in Shah Alam, Selangor, May 2005 and with Mr. Salem, FNSS Savunma's representative in Malaysia based at the DEFTECH plant in Pekan, Pahang. Fieldwork survey in Malaysia May-June 2005 .

[95] Interview with former ATSC officer. Fieldwork interview in Malaysia, June 2005.

[96] Interview with Mr.Amasov, Head of Offsets Programme for Rosoronboronexport and Mr. Victor Kladov, Russian Defence Attaché to Malaysia. Fieldwork in Malaysia, June 2005.

[97] Questionnaire response from OEMs. Fieldwork in Malaysia, May –July 2006.

[98] Questionnaire results. Fieldwork survey in Malaysia, April-July 2005.

[99] Mr. Juan Emmanuel Garcia, Navantia, Spain. Fieldwork questionnaire response and interview in Madrid, Spain. Fieldwork in Malaysia , June 2005, and an interview session in Madrid, December 2005.

[100] Information obtained through fieldwork in Malaysia, April-July 2005. Feedback about the language proficiency of the local workers was also obtained from OEMs through interview (refer question 3.6,3.8 and 3.10 of the OEM questionnaire).

[101] Interview with Major (Rtd) Shantanam, SMEA offsets project manager. Fieldwork in Malaysia, June 2005.

[102] Interview with Mr. Ang Ewe Jin , UPECA Engineering Sdn Bhd. Fieldwork survey , June 2005.

[103] Interview with Mr. Ang Ewe Jin , UPECA Engineering Sdn Bhd. Fieldwork survey , June 2005.

[104] Interview with Mr. Ang Ewe Jin , UPECA Engineering Sdn Bhd. Fieldwork survey , June 2005.

[105] Interview with Mr. Wan Shahruddin, CEO, Sapura Defence, Malaysia. Fieldwork survey, June 2005.

[106] Interview with Mr. Kamarulzaman Ariffin, Offsets Manager, Sapura Defence, Mines Resort, Sri Kembangan, Kuala Lumpur. Fieldwork in Malaysia, May 2005.

[107] Wan Sharuddin, Offsets: The Sapura Defence Experience, *In*: 05 *Offsets Workshop, Menara Kuala Lumpur, 7 July 2005,* (MOD Malaysia and Cranfield University, Kuala Lumpur, 2005).

[108] Wan Sharuddin, The Challenges of Indigenisation in Malaysia, *In: 06 International Offsets Conference*, 11-12 April, Subang Jaya, 2006. (Defence Services Asia Exhibition, Kuala Lumpur, 2006).

[109] Fieldwork interview with Mr. Kamarulzaman Ariffin, Offsets Manager, Sapura Defence, Mines Resort, Sri Kembangan, Kuala Lumpur, June 2005

[110] Interview with Colonel (Rtd) Ahda, MMC Defence, Nilai, Malaysia, June 2005.

[111] Defence Industry Division, MOD Malaysia. Fieldwork survey, 30April-31July 2005.

[112] Interview with Colonel Hanafiah, Offsets Unit, DID, MOD Malaysia. Fieldwork in Malaysia, May 2005.

[113] Data obtained through fieldwork survey in Malaysia, April-July 2005.

[114] Information obtained through interview with local companies. Fieldwork survey in Malaysia, 30 April-31 July 2005.

[115] Interview with Colonel (Rtd) Rosdi, CEO of CTRM, Cyberjaya, Kuala Lumpur, June 2005. Colonel (Rtd) Rosdi, Development Through Offsets: Offsets in the Global Supply Chain Environment, *In: 05 Offsets Workshop, Mega View Banquet Deck, Menara Kuala Lumpur, 7 July 2005*,(MOD, Malaysia and Cranfield University, Kuala Lumpur, 2005),

[116]Results obtained from questionnaire analysis. Fieldwork in Malaysia, April-July 2005.

[117] Interview with Colonel (Rtd) Rosdi Ahmad, CEO, CTRM in Cyber Jaya, Malaysia, June 2005. Interview with Tuan Syed, CEO, Ikramatic, Shah Alam, Malaysia, June 2005.

[118] Interview with M Ang Ewe Jin, UPECA Engineering, Shah Alam, May 2005.

[119] Interview with defence suppliers. Fieldwork in Malaysia, April-July 2005.

[120] Questionnaire survey results. Fieldwork in Malaysia, 30 April-31July 2005.

[121] Question posed by industry representative at the DKF industry member during paper presentation by author on Offsets Policy in Malaysia, Karlshure, Germany, June 2006

[122] Questionnaire response, SMEA, Fieldwork survey in Malaysia, May 2005.

[123] Interview with CEO of SME Aerospace, Mr. Chee Ng Boon , Sg. Buloh, Selangor, May 2005.

[124] However, the survey results could not capture the actual total figure of new work generated due to offsets, as most of the companies had not captured the additional figures prior to and after offsets work.

[125] Interview with Major (Rtd) Shantanam, SMEA, Offsets Programme Manager, Sg.Buloh, Selangor. Fieldwork in Malaysia , May 2005.

[126] Interview with Mr. Eugene, UPECA Engineering, Shah Alam during fieldwork in Malaysia, May 2005.

[127] Eurocopter registered Euro 2.8 billion in sales with 55% of world's market share for civil and defence helicopters. Philippe Lubrano, The Challenges of Viable Partnership, *In: 05 Offsets Workshop, Menara Kuala Lumpur, 7 July 2005*, (MOD, Malaysia and Cranfield University, Kuala Lumpur, 2005).

[128] Interview with Mr. Philippe Lubrano, CEO, Eurocopter Malaysia, Subang, Selangor. Fieldwork in Malaysia, June 2005.

[129] Interview with Mr. Philippe Lubrano, CEO, Eurocopter Malaysia , Subang , Selangor. Fieldwork in Malaysia, June 2005.

[130] This issue was raised during discussion with Mr. John Northridge (Senior Vice President), Mr. David Mc Llvena (International Industrial Participation Director) and Mr. David Jones (Regional Director, Malaysia), Rolls Royce, May 4 2005. Fieldwork survey in Malaysia.

[131] Questionnaire survey response. Fieldwork survey, 30 April-31 July 2005.

[132] Hawk Offsets Report, Defence Industry Division, Ministry of Defence, Malaysia, 1992.

[133] Interview with a defence industry member. Fieldwork in Malaysia, June 2005. Author was unable to speak to anyone from PSCNDSB during the fieldwork as all staff was forbidden from communicating with outside sources during this period. The company was going through liquidisation and was in the process of being taken over by the government.

[134] Interview with Mr. Chee Ng Boon, CEO, SMEA, Sg. Buloh, Selangor during fieldwork survey in Malaysia, May 2005 and telephone interview in June 2006.

[135] BAE Systems, Farnborough office, United Kingdom, September 2004.

[136] Malaysia. Malaysian Industry Government Group for High Technology (MIGHT), *A Study on Offsets Programme of the National Defence Procurement*, (Prime Minister's Department, Putra Jaya, November, 2001), (restricted).

[137] Information obtained during fieldwork in Malaysia, 30 April-31 July 2005.

[138] Information obtained from questionnaire survey and interview with Mr. Ang Ewe Jin, UPECA Engineering, Malaysia, June 2005.

[139] Information obtained s with offsets recipient in an aerospace company, dated 15 May 2005.

[140] Information obtained s with offsets recipient in an aerospace company, dated 15 May 2005.

[141] Interview with Tuan Syed M.Jamil, CEO Ikramatik, during fieldwork research in Malaysia, HICOM Glenmaries Industrial Park, Shah Alam, June 2005.

[142] Interview with Col (R) Kamaruddin Kamarulzaman, .Zetro Aerospace Corporation Sdn Bhd, Jln Yap Kwan Seng, Kuala Lumpur during fieldwork research in Malaysia, June 2005.

[143]Philippe Lubrano, The Challenges of Viable Partnership, *In: 05 Offsets Workshop, Menara Kuala Lumpur, 7 July 2005,* (MOD, Malaysia and Cranfield University, Kuala Lumpur, 2005).

[144] Figure obtained as a result of fieldwork survey in Malaysia during interview with offshore vendors supplying defence equipment to Malaysia, April-July 2007.

[145] Information obtained from open-ended interview with defence contractors supplying to Malaysia, 30 April-31 July 2005.

[146] David Jones of Rolls Royce argues that OEMs must also be sensitive towards the needs of Malaysian government and companies and provide matching requirements, April, 2006.

[147] Interview with Colonel (Rtd) Hugh Stott and Alan Harrison, Alvis Bridging, Wolverhampton, February 2005, during author's fieldwork survey at the Alvis Bridging company site. Email reply from Alan Harrison dated 21 February 2005.

[148] Interview with Colonel (Rtd) Hugh Stott and Alan Harrison, Alvis Bridging, Wolverhampton, February 2005, during author's fieldwork survey at the Alvis Bridging company site. Email reply from Alan Harrison dated 21 February 2005.

[149] Interview with Charlie Blackmore and Col(Rtd) Hugh Stott of BAE Land (Previously known as Vickers Bridging) at their company premises in Birmingham, March 2005.

[150] Information obtained during author's site-visit to the CTRM manufacturing plant in Malacca, Malaysia, May 2005.

[151] Interview with Colonel (Rtd) Narinder Singh, DEFTECH, Shah Alam during fieldwork survey in Malaysia, May 2005.

[152] Information obtained from fieldwork interview in May 2005, Malaysia.

[153] Information obtained from fieldwork interview in May 2005, Malaysia.

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Chapter 6

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

6.0 Introduction

This final chapter seeks to offer conclusions and policy recommendations from the research results. It also considers the extent to which these findings may be specific to Malaysian industry, particularly to the defence industry. It further examines how relevant these findings are to the main policy issues and concerns of the Malaysian government. Finally it reflects on the study, suggesting some implications and opportunities for further research.

This chapter is arranged into four sections. Section 6.1 provides a summary, addressing the fundamental theoretical issues emerging from the literature review. It focuses on the issues of development, industrialisation, technology development, and the technology transfer process, including the need to achieve competitive advantage and technology development capability within developing countries. This section also elaborates on the role of offsets as a means to industrial and technological development and the specific role of offsets in developing Malaysia's defence industrial and technological base. Section 6.2 provides the conclusions derived from the Chapter 5 empirical analysis. This section highlights the success, or otherwise, of offsets in Malaysia, including the reasons for the success and failure. Section 6.3 proposes policy recommendations for the Malaysian government to initiate steps to increase effective utilisation of offsets, enhancing Malaysia's industrial and technological base. The final section 6.4 proposes areas for further research.

6.1 Summary

6.1.1 Industrial and Technological Development

Chapter two defines economic development as constituting the political and economic processes necessary for effecting rapid structural and institutional transformation of countries. Based on this definition, it is argued that developing countries decide to embark on industrialisation and technological development as a means to complement and accelerate national economic development. Industrialisation is also viewed as a lever to realise economic prowess and national prestige. Further, there is a strong desire amongst peripheral nations to draw level with core industrialised nations, and in the process attain self-reliance in the long-run. However, unlike the market-led liberalised industrial policies of the West, most developing countries have opted for *selective government intervention* to facilitate structural change and the smooth flow of inward technology transfer. The State takes a pivotal role in steering and realising national industrial and technological development. Chapter two discusses how the NICs, in particular, implemented a liberal market-driven EOI policy to drive inward investments, opting also for selective interventions with respect to an ISI policy, ensuring substantial domestic industrial and technological development leading to innovation and indigenisation.

Chapter two additionally discusses the importance of technology transfer. Technology transfer is promoted for various reasons, including commercialisation, profit- making, the formation of strategic alliances, cost-sharing, venturing and the development of cutting-edge innovative technologies. There is a compulsion amongst developing nations to acquire leading technologies to assuage the risk of lagging behind if they don't 'catch-up' with the developed world. At the macro-level, a public-private partnership in research between government agencies, universities and industries is crucial to ensure that effective technology transfer and absorption occurs. Meanwhile, at the micro-level, corporate commitment towards infrastructural investments, human resources and R&D is crucial for effective technology absorption and capability development. Technology, in this regard, is obtained through various modes, including foreign direct investment, turnkey projects, licensing, sub-contracting, joint-ventures, collaboration as well as R&D. Overall, technology development involves technology acquisition, adaptation and modification, creating the conditions for indigenisation of competitive industries. Finally, the chapter examines how defence offsets have been employed by many nations to develop their industrial and technological bases.

6.1.2 Defence Offsets and Defence Industrialisation

Defence offsets are used for various reasons including the acquisition of technology, the development and strengthening of the local defence industrial base, employment creation, human resource development, and value-adding industrial development. As discussed in Chapter 3, there is absolutely *'no one size fits all'* offsets policy or strategy. Each country develops its own policy and strategy according to national, political, security and economic considerations. Offsets practices are complicated and differ according to each country's procurement planning and operational processes. Further, offsets are clouded by technical jargon, requiring an in-depth understanding of the subject. This study has looked at the various challenges of offsets practices, culminating from the lack of non-uniformity of offsets practices, technology transfer and pricing issues. An important dimension highlighted in this study is the identification of offsets success factors. Chapter 3 discusses the key determinants to offsets success, including buyer government policy, strategy, OEM commitment, local technological absorption capability, the assistance and technical quality of contracting networks, industrial strategy and human resource development capability. Chapter 3 offers various examples of how offsets have worked in both developed and developing countries. These examples have been drawn from several country case studies of offsets experiences.

6.1.3 Malaysia's Defence Industrial Base and the Role of Defence Offsets

Malaysia embarked on defence industrialisation at the start of the 1980s, in line with the country's national goal to venture into heavy industry as part of its import substitution policy. Defence industry since then, has developed gradually from being a totally State-owned enterprise operation into one more akin to private enterprise. The government's adherence to the principle of public-private partnerships has encouraged the MOD to adapt the 'Malaysia Incorporated' policy towards developing Malaysia's defence industry for economic, strategic, and security reasons. The Malaysian government's initiative in developing its defence industrial base has been multi-faceted. Defence procurement and offsets have been utilised to transfer technologies, creating partnerships and collaborative ventures between local and overseas firms in defence projects. Offsets are viewed as a catalyst to enhance and strengthen the defence industrial base, creating in the process, employment, skilled human resources, and technology development capability.

Chapter 4 discusses the development of the six leading sectors of the Malaysian defence industry as per the MDIC categorisation (see Section 4.8). The different levels of development within each sector are strongly linked to Malaysia's national industrial strategy. The aerospace and ICT sectors, have taken the lead in the defence sector by acquiring higher-end technology development capability as compared to other sectors, such as land, air and maritime activities. This study found that the uneven development is linked to Malaysia's strength in the civil aerospace and electronics sectors. Overall, after almost 30 years of defence industrialisation effort, Malaysia is still lagging behind some of its neighbouring countries in relation to defence technology and human resource capabilities.

Offsets programmes, introduced into Malaysia's defence sector since the early 1990s, have largely concentrated on acquiring basic training and human resource development for the Malaysian Armed Forces personnel and defence industry members. Although the offsets policy objectives are explicit about the need for more collaborative R&D projects, leading to commercialisation, some 60% of the offsets projects were for training and through-life support of the equipment and systems purchased. The Malaysian government has from time to time reviewed the offsets policy, incorporating incentives to lure more substantial long-term projects into the industry. However, this is not well reflected by the nature of the final projects.

Chapter 5, critically analyses the success and failure of offsets in Malaysia, directed at pertinent issues such as offsets policy, implementation process, strategy as well as the impact of offsets on Malaysia's defence industrial and technological base.

6.2 Conclusions

Employing the Chapter 1's conceptual framework, Chapter 5 analyses the major issues associated with measuring the effectiveness of defence offsets and how they have been employed to progress industrial and technological development of Malaysia's defence industrial base.

6.2.1 Key Conclusions from Chapter 5 Analysis

Malaysia's defence offsets policy has been pragmatic, providing flexibility for technology transfer. For greater efficiency in offsets implementation, offsets planning and implementation processes must be systematic. This is highly dependent on how the offsets policy is formulated, requiring a well-planned selection of technology; as well as sound implementation and coordination of projects. The Malaysian offsets process and implementation, nevertheless, lacks compliance with the offsets policy objectives. There is still a lack of clarity in the offsets implementation, process, and this has led to the lack of a systematic procedure to identify, select, acquire and develop technology. The risk of unsuccessful transfer may exist when there is a lack of planning on technology selection and *ad-hoc* selection of recipients, without a preliminary audit.

Malaysian defence offsets have been used to absorb technology in both the defence and non-defence sectors. Offsets have been instrumental in transferring know-how through hands-on training, provided locally and abroad by suppliers. The transfer of skills and knowledge has been through on-the-job training, transfer of manuals, documents and drawings into hardware, including the production of jigs and tools. In the case of defence production, these transfers have assisted many Malaysian companies to obtain quality assurance certification. Offsets have assisted in infrastructural development, systematic documentation, technological learning and development. Technology development has been largely successful to the extent of supporting MOD Malaysia contracts. Offsets have also been utilised to enhance the human resource base, in line with the Vision 2020 goal of creating a knowledge-based society. Offsets have been mainly used to train MAF and industry personnel to undertake defence-related work.

However, technology transfer and adaptation by itself will not be sufficient if the industries cannot sustain their businesses or are unable to utilise the skills acquired for further development. What is required is that offsets projects are well-planned and not ‘one-off’ activities and that they are able to secure work from the foreign vendors’ value chains, through buy-backs, joint-ventures and co-production.

6.2.2 Successful Outcomes through Offsets

This study indicates (Chapter 5, Section 5.4) that defence offsets in the Malaysian defence industry context, have been successful in the following areas:

- **Technology Capability Development (Chapter 5, Section 5.4.1)**

  Offsets have been used to acquire technology from various sources linked to defence capital goods purchases. These sources include the US, the UK, Europe, Russia, Poland and South Korea. Offsets have been successful in creating basic technology development capabilities leading to process and product development, enhancement of management techniques and know-how. However, as most of the technology transfer activities have been in the form of basic training, MRO, build-to-print types of manufacturing, as well as final assembly, this has not added to innovational capability. Substantive technological capabilities have been developed within the Malaysian Armed Forces and Malaysian defence industry to undertake work in support of maintaining a self-reliant MAF. Maintenance, repair, over-haul and up-grade work, especially in the aerospace and automotive sectors, is now able to be undertaken locally (refer to Chapter 5, Section 5.3). Table 5.9 5 illustrates the types of offsets activity in Malaysia. The Table clearly indicates that 58% of all technology was transferred for training followed by 18% for MRO work.

  This ‘measured’ success is attributable to the government’s fundamental objective of creating a defence industrial base supportive of a self-reliant

MAF. The offsets objectives have, to this effect, been largely focused on obtaining capabilities to enhance the MAF and the defence industry in through-lifeequipment support.

- **Skills Enhancement (Chapter 5, Section 5.4.7)**

  Defence offsets have been successful in developing skills amongst the MAF and Malaysian defence industry personnel. The government's focus since the initial stages has been focused on using offsets to develop various training programmes. This has directly fostered the development of local skills in focused technologies, particularly defence and aerospace related technologies. Skills enhancement has been mainly in the areas related to MROs, up-grades, sub-assemblies, basic or 'build-to-print' components manufacturing, logistics support, spares management, documentation processes, as well as improvements in general management techniques and procedures. However, human resources expertise is not maximised due to limited capacity utilisation.

- **Diversification (Chapter 5, Section 5.4.8)**

  Defence Offsets have been successful in creating diversification into the civil arena. Companies which started with small defence offsets projects, especially in the manufacturing of aerospace parts and components, have developed their capabilities in related technologies. Such newly acquired expertise has helped such companies to venture into civil projects at the global level, creating higher value-added components. These new opportunities have allowed Malaysian companies to engage in competitive tendering and if successful, qualify as part of an international supply chain. Two successful examples of civil diversification quoted in Chapter 5 (Sections 5.4.3 and 5.4.8) are SME Aerospace and CTRM. SME began life by manufacturing Hawk pylons for BAE Systems as part of the Hawk offsets project and is today a leading manufacturer of metal-based tools, as well as parts and components for the Airbus and Boeing aircraft series. Similarly, CTRM acquired composite technology through the Hawk offsets programme, and has today built on those capabilities to become an international partner of EADS and Boeing in producing composite parts for their aircraft.

Diversification though offsets appears to work better in Malaysia for the following reasons:

- possession of a strong civil-based industry, especially in electronics and aerospace (Chapter 4,Section 4.7). This is supported by the business structure of Malaysia's defence companies, being civil-defence based (Chapter 4, Section 4.3).

- OEMs are more receptive towards transferring non-defence technologies and collaborating on civil projects (Chapter 5, Section 5.5).

- Offsets have been successful in enhancing and strengthening existing strong backward linkages within the civil sectors, mainly again in electronics and aerospace (Chapter 4, Section 4.9). Local companies find it easier to source from companies with generic expertise, such as in wiring, painting, machining and cabling.

6.2.3 Malaysia's Offsets Success Factors

Generally, Malaysia's defence offsets success in enhancing the country's industrial and technological base can be attributed to the following factors:

- An offsets policy that provides flexibility, both for the offsets obligor and the recipients, to discuss and produce offsets projects that fulfil national objectives (Chapter 5, Section 5.1).
- Pressure to ensure that the Offsets Policy operates in tandem with National Development and Technology Policies (Chapter 5, Section 5.1).
- Government initiatives to continuously review and enhance offsets policy and implementation in order to achieve better results (Chapter 5, Sections 5.2.2 and 5.2.3).

- Government's strong public-private partnership with Malaysian companies to ensure successful transfer, adaptation and indigenisation of technology (Chapter 5, Section 5.2.1).
- Strong Government collaboration with foreign governments and OEMs through various bilateral platforms, providing incentives to promote defence industry and technology cooperation (Chapter 5, Section 5.2.3).
- Willingness of Malaysian labour to learn and absorb 'soft' technology (Chapter 5, Section 5.3.1).
- Willingness and commitment of OEMs to ensure that offsets projects are delivered according to contract, fulfilling obligations (Chapter 5, Section 5.5).

6.2.4 Less Successful Outcomes from Offsets

The research findings indicate (Section 5.4) that Malaysian defence offsets have been less successful in the following areas:

- **R&D Leading to Indigenisation (Chapter 5, Sections 5.4.1 and 5.3.3)**

There is a significant lack of R&D type initiatives within defence offsets projects (Chapter 5, Section 5.3.2).

The lack of R&D activities and associated promotion of innovation in the defence sector are due to the following reasons:

- Lack of government support and investment in defence R&D (Chapter 5, Table 5.16)
- Minimal R&D-type projects obtained through offsets (Chapter 5, Table 5.9)
- Absence of specific requests within the offsets terms and conditions for R&D type projects (Chapter 5, Table 5.3)
- Limited explicit interest within the offsets policy for incentivising R&D- type projects (Chapter 5, Section 5.1.1)
- Restricted local company commitment and investment into R&D (Chapter 5, Table 5.14)
- R&D facilities in Malaysia's defence companies (Chapter 5, Section 5)

- Limited coordination of R&D activities between STRIDE and other defence-related research organisations, universities and defence industry (Chapter 5, Table 5.15).

As R&D lies at the core of technology development, contributing significantly to knowledge development, efforts should be taken to enhance the importance of this activity, investing in core competencies. STRIDE, together with other defence related agencies, universities and defence companies should:

- Facilitate technology transfer through defence procurement/offsets
- Identify key defence technology requirements for defence industry
- Chart Malaysia's defence technology requirements and capability development plans
- Generate defence-related projects
- Invest in defence R&D projects
- Initiate commercialisation of defence-related R&D projects
- Enhance closer cooperation between local companies, OEMs, foreign governments, and other research agencies, through formal and informal platforms (Chapter 5, Section 5.4.2).

- **Dual-use Technology (Chapter 5, Section 5.4.2)**

This study found that offsets have not been maximised by MOD to leverage dual-use technologies. There are opportunities to acquire specific technologies such as GPS, and computer-related technologies that are applicable to both the defence and civil sectors. Unfortunately, technologies obtained through offsets have mainly been focused on defence, particularly technologies that are not convertible, such as in the defence-related fields of MRO, assembly and manufacturing.

Policy initiatives should be aimed at:

- Leveraging more dual-use technologies; this is particularly appropriate given that Malaysian defence companies are civil-defence based.

- Ensuring that dual-use technologies are more marketable and cost-efficient
- Achieving a wider choice in terms of application, requiring dual-use technology to be less complicated, less sensitive and more easily adaptable for export to overseas commercial markets.

- **Sub-Contracting Base (Chapter 5, Section 5.4.3)**

  In respect of sub-contractorisation and the creation of backward linkages, defence offsets have failed to develop a substantive supplier network within the Malaysian defence industrial base. As discussed in Chapter 5, sections 5.4.3 and 5.6, the Malaysian prime contractors, vertically integrated business operations have not been supportive of vendor development. Many of the smaller companies have not been given equal opportunity to participate in projects. Thus, these companies have been denied opportunities to enhance their capabilities and compete internationally. Further, there is lack of confidence amongst the OEMs and the MAF (users) to allow participation by the Malaysian sub-contractors in developing or contributing towards local content within the equipment and sub-systems purchased. These constraints are based on the perceived lack of security and quality assurance in the Malaysian production processes and procedures. There is also the view that insufficient work is generated through offsets to justify local subcontract engagement.

  Notwithstanding the above reservations, the government should enforce a stronger sub-contracting programme within the defence sector. This should be followed by constant monitoring of the work-flow to negate monopoly practices by the prime contractors. At the same time, offsets should be used to bring in more work packages that create work and enhance backward linkages. Higher incentives should be awarded to OEMs such as BAE, Boeing and Eurocopter Malaysia to bring work packages into the country.

- **Market Penetration (Chapter 5, Section 5.4.4)**

  Offsets have failed to create marketing opportunities for Malaysian defence companies. Findings in Table 5.26 show that only 25% of respondents agreed that their companies had benefited from marketing activities through offsets. This is because the government and local companies do not have a structured marketing strategy to develop and promote products overseas. Most marketing initiatives are done on an *ad-hoc* basis.

- **Defence Exports (Chapter 5, Section 5.4.5)**

Similarly, minimal defence exports have been generated through offsets activities. Section 5.4.5 shows that only 10% of respondents confirm that exports have emerged from offsets activities. The nature of Malaysian offsets projects are largely focused on training, reducing the capability of local companies to embark on technology development that could lead to innovation and exports. Further, the offsets negotiated lack provisions for buy-backs, joint-production or licensed production in the defence industry sector. Of greater concern, is that there are no explicit policy intentions to promote such ventures.

- **Job Creation (Chapter 5, Section 5.4.6)**

Section 5.4.6 indicates that there have been minimal jobs created due to offsets activity in Malaysia. This is again linked to the argument that the country's offsets projects have largely been concentrated on training and not on commercially viable projects through joint-ventures, co-production and licensed-production that potentially could generate high level of employment. Nevertheless, Section 5.4.6 also indicates that high and low technology work have been generated, mainly in areas such as CNC machining, welding, software development and programming, as well as simulator development.

- **Sustainability (Chapter 5, Section 5.6)**

Finally, in relation to the issue of sustainability, the research findings indicate that offsets have been less successful in sustaining Malaysia's defence industrial base. Section 5.6 offers several in-depth case studies on offsets-related projects that have faced survival challenges. The difficulty in transferring defence technologies, the high cost involved in terms of technology and infrastructural investments, and the long-lead time for returns on investment have made the survivability of Malaysian defence businesses more difficult. Production or assembly of defence equipment is rarely sufficient to ensure a company's long-term survival.

Acquisition orders are often not large enough to compensate for infrastructural investment to ensure a significant revenue stream over more than a few years. The potentially short-term nature of defence business also impacts on the retention of skilled workers, such as welders, engineers and software and systems specialists. Sustainable business is often only possible if there is a high level of commitment from the government to invest in such industries. For their part, Malaysian companies have to aggressively embark on indigenous technological development with a view towards becoming part of an international defence supply-chain. For this to happen, local defence firms must also be equally willing to invest in R&D and marketing.

As Malaysia's offsets activities are closely managed by the government, the selection of technology, and, to a large extent, the selection of the technology recipient companies are determined by the government. To ensure effectiveness, the government must ensure:

- A systematic technology selection process incorporating relevant macro policies.
- Transparency in the technology recipient selection process and auditing of the recipient's capability to absorb the technology.
- Consultation with local companies and OEMs over the transfer process, obtaining frequent feedback on issues that could affect the transfer process.
- Coordination and collaboration on technology selection and development between local companies and government agencies, such as STRIDE and MIGHT.

Based on these conclusions, this study puts forward several policy recommendations that could increase the effectiveness of offsets in strengthening Malaysia's defence industrial base.

6.3 Policy Recommendations

Malaysia's progress towards developing its defence industrial base has been measured rather than dramatic. The country's efforts to enhance its defence industrial and technological capability have been solely linked to defence procurement and offsets. Much of Malaysia's defence industrial growth over the past 30 years has been focused largely on basic technology development, particularly training and basic through-life support of weapon systems. As a result, defence capability is largely centred on MRO activities, with limited investment in joint-ventures, collaboration and R&D work as well as minimal progress in promoting exports and marketing. Constraints on indigenisation through technology transfer are largely because of the weaknesses following:

- Progress identifying suitable offsets projects capable of enhancing capabilities within the different defence industry sectors
- Lack of a clear offsets implementation strategy able to realise offsets policy objectives
- Absence of a defence industrial blueprint or policy that would direct defence industrial development
- Absence of a Defence Science and Technology Policy outlining the types of technology and R&D activities required by the Malaysian defence sector.

This study's findings suggest that Malaysia needs a Defence Offsets Policy (DOP) coordinated and supported by a Defence Policy (DP), Defence Industrial Blue-Print (DIBP) and a Defence Science and Technology Policy (DSTP); this being required to enhance defence industrial and technological development.

The existing offsets policy provides little emphasis on commercial projects, especially in direct-offsets related activities. As a result, many of the offsets projects are focused on technology transfer in areas such as ‘one-off’ training to the Malaysian Armed Forces or industry personnel. On many occasions, the ‘know-how’ gained is not converted into tangible commercial outputs. The offsets policy needs to consider objectives beyond basic training and ‘know-how’, focusing instead on the utilisation of technology gained for further development, leading to indigenisation.

6.3.1 Review of the Malaysian Offsets Policy

This study’s findings suggest that the Malaysian offsets policy needs to be reviewed. For this, the offsets policy should comprise the following components:

- **Technology Capability Development:** the emphasis is on joint-ventures, co-production and R&D-based collaborative offsets projects. This could be done through offering the OEMs higher multipliers for such projects. Additionality and causality must be established when acquiring such technologies. The offsets policy should extend the National Innovation Systems to defence R&D applications. This should be carried out by offering attractive incentives for R&D-based partnerships between local companies and OEMs.

- **Attractive Multipliers**: the Malaysian government should consider providing higher value but nevertheless realistic multipliers to encourage OEMs to introduce more attractive investments, especially in the high-technology sectors. Multipliers should be tied to long- and short-term outputs, such as work- generated profits, exports, buy-backs and R&D activities, leading to indigenisation, particularly in dual-use technology. Multipliers should not be fixed but be subject to negotiation between the buyers and sellers to ensure maximum returns.

- **Value-Added Activities:** there is a need to introduce transaction value measurement mechanisms to achieve on tangible results from value-added offsets activities. This includes incorporating mechanisms or formulae to count the value-added output of each recipient industry.

- **Enhancement of Backward Linkages:** there is a need to incorporate mechanisms in the offsets policy to ensure the promotion of sub-contracting activities. There must be procedures to monitor the trickle-down effect of work from Malaysian prime to sub-contractors. Perhaps awarding points or rewarding primes that could generate substantial sub-contracting work based on the size and value of the offsets projects. The MOF and MOD Malaysia should together study the success models of SME development.

- **Pre-Offsets Credits:** there is a need to create mechanisms within the Malaysian MOD, for the banking of offsets credits. As Malaysia is constantly procuring arms and related systems from overseas, there is a tendency for OEMs to continue to seek investment opportunities within the country irrespective of future defence procurement contracts. In such instances, the government should offer offsets credits banking in lieu of future purchases as a means of securing good projects. Credits could be given a shelf-life of between 3-5 years, after which they automatically expire in the absence of procurement contracts.

- **Enforcing Sustainability:** a through life study should be undertaken to evaluate the sustainability of projects to be carried-out. The outcomes of the study should be presented to the Countertrade Committee, outlining the strengths and weaknesses of the projects as well as short- and long-term outcomes. Such action will hinder investing into unsustainable projects and redirect offsets into projects that are more long-term and viable. The DID, MINDEF, should undertake this study.

- **Offsets Monitoring Process:** there is a need to identify and implement processes for the monitoring of periodical submission of documents, constant follow-ups and follow-throughs with the OEMs and recipients with respect to offsets projects development.

- **Offsets Implementation Process**: there is a need to ensure that the offsets objectives are translated into tangible outcomes. The Defence Industry

Division, MOD, should put in mechanisms and processes to ensure offsets projects are carried out according to the policy objectives.

- **Formation of an Offsets Team:** there is a need to ensure that sufficient importance is given to the offsets team to identify and plan local content as part of the formal defence procurement process. The offsets team should be formed in parallel with the price and technical negotiation teams. The offsets team should comprise Armed Forces personnel, officers from the Defence Industry Division, MINDEF, and selected Malaysian companies.

- **Formation of the Countertrade/Offsets Committee:** there is a need to formalise the Countertrade/Offsets Committee, requiring that it be chaired by either the Minister of Defence or the Secretary General, MOD. This will ensure clarity and transparency in the selection and awarding of offsets-related projects to qualified recipients. It is suggested that the Defence Industry Division should provide the secretariat to this committee and members should be elected at two levels: permanent members and *ad-hoc* members.

- **Continuous Offsets Education:** there is a need to provide continuous education on offsets to officers negotiating offsets. This should be carried out through workshops, conferences and forums on an annual basis. The National Defence University, Malaysia, should run annual conferences on Offsets at the regional level. Further, a short course on offsets should be offered by the MNDU, catering to the Asia Pacific region, educating government and industry members within the region on offsets policies and practices. A regional offsets grouping championed by Malaysia with joint secretariat by the Ministry of Finance and MOD, Malaysia, should be formed to exchange ideas on issues related to Countertrade/Offsets activities in the Asia-Pacific region.

6.3.2 Formulation of a Malaysian Defence Industrial Strategy (MDIS)

It is recommended for a Formulation of the Malaysian Defence Industrial Strategy (MDIS). Based on the National Industrial Master Plan (IMP), the Malaysian government should formulate a MDIS, to operate in tandem with the IMP. The MDIS should be utilised as a fundamental document to chart the direction of Malaysia's defence industrial development.

The MDIS should:

- Define the parameters of Malaysia's defence and national security policy and the role of defence industry in supporting national security.
- Craft its own vision, mission and objectives.
- Develop macro and micro level policy, strategy and implementation processes.
- Identify and articulate Malaysian defence industry capabilities according to the various sectors at the different levels of capability development
- Direct the future capability of different defence industrial sectors.
- Develop strategic action plans.

6.3.3 Formulation of a Malaysian Defence Science and Technology Strategy (DSTS)

It is recommended that a Malaysian Defence Science and Technology Strategy (DSTS) be formulated. It is vital that the Malaysian Defence Industrial Strategy be supported by a MDTS. This study's findings suggest that the DSTS operate in tandem with the National Science and Technology Policy. The MDTS should be used as a vital policy document to guide Malaysia's defence industrial development and progress. The lack of R&D initiatives within the Malaysian defence sector points to the absence of a DSTS to offer a coordinated approach towards the development of an indigenous defence industrial base.

The MDTS should promote:

- Scientific research and experimental design work
- The financing of S&T research projects through defence procurement/ offsets
- Capital investments in the development of defence S&T
- Technology transfer through defence procurement/offsets, identifying and selecting the most appropriate technology
- Policies to ensure appropriate absorption, adaptation and assimilation of technology to suit the Malaysian environment
- Policies for developing human resources and infrastructure
- Provision for specialist advice to the Minister and policy-makers
- Greater visibility and clearer understanding of research outputs and their costs.

The Malaysian Defence Science and Technology Strategy should support the offsets policy in creating spin-offs for macro-economic development, human resource development in high-technology sectors, particularly defence and aerospace, and improvements in defence industrial infrastructure. STRIDE should become the central coordinator and lead player for this policy. STRIDE should coordinate all defence S&T related activities within and outside Malaysia in partnership with Malaysian companies, OEMs, overseas governments and other defence think-tanks. STRIDE should also form a steering-committee for all defence R&D projects. The Defence Science and Technology Strategy and its steering committee should assist in identifying suitable R&D projects from offsets activity.

6.4 Proposals for Further Research

Limited research has been undertaken in the field of offsets. This is one of the few empirical studies evaluating the effectiveness of offsets in developing countries, and thus more research is required on:

6.5 The Impact of of Counterpurchase

As counterpurchase forms a substantial portion of Malaysia's countertrade activity, there is a need to look into the impact of this tool on Malaysia's economic development. Counterpurchase will continue to feature as an important element within the overall countertade programme. To this effect, the impact of issues such as *additionality* and *causality* on counterpurchase activities will be of continuing concern, requiring a detailed study of how counterpurchase impacts on the Malaysian economy.

6.6 Focused Case-Study

This study adopted a broad approach in the survey of offsets recipient companies. Therefore, many of the issues have been addressed at a broad cross-sectional level of analysis instead of deeper longtitudinal study. A case study would have provided a more focused analysis of corporate development through offsets-related technology transfer.

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APPENDICES

Appendix A: List of items procured by Ministry of Defence, Malaysia

Num	Country	Equipment	Ord	Delv	Num	Comments
1	France	AS-555UN Fennec Light helicopter	2001	2003	6	Deal worth $38m
2	France	MM-40 Exocet Anti-ship missile	1993	1996	16	For Lekiu Class frigates
3	France	MM-40 Exocet Anti-ship missile	1993	1998	4	For Lekiu Class frigates
4	UK	Seawolf VL SAM	1993	1998	1	For Lekiu Class frigates
5	UK	Seawolf VL SAM	1993	1999	33	For Lekiu Class frigates
6	UK	Starburst Portable SAM	1993	1995	150	
7	UK	Starburst Portable SAM	1993	1996	177	
8	UK	Starburst Portable SAM	1993	1997	177	
9	USA	AIM-9S Sidewinder SRAAM	1993	1997	40	"For F/A-18D FGA aircraft; no. delivered could be 86"
10	Russia	MiG-29S/Fulcrum-C FGA aircraft	1994	1995	18	"Deal worth $600m (offsets $220m including $150m barter); MiG-29N version; including 2 MiG-29NUB version; deal including modernization within few years"

Num	Country	Equipment	Ord	Delv	Num	Comments
11	USA	AIM-7M Sparrow BVRAAM	1993	1997	20	"For F/A-18D FGA aircraft; no. delivered could be 51"
12	USA	RGM-84 Harpoon Anti-ship missile	1994	1997	25	X "AGM-84A Block-1C version; for F/A-18 FGA aircraft"
13	USA	F/A-18C Hornet FGA aircraft	1993	1997	8	F/A-18D version (offsets $250m)
14	USA	AGM-65D Maverick ASM	1993	1997	30	For F/A-18D FGA aircraft
16	South Korea	KIFV APC	1993	1993	42	"Deal worth $25m; for use with Malaysian UN forces in Bosnia; including 4 APC/mortar carrier, 2 ARV, 2 APC/CP and 2 ambulance version"
17	Indonesia	CN-35 Transport aircraft	1995	1999	6	"Option on 12 more; deal worth $101m (barter/offsets including 20 MD-3-160 trainer aircraft and 500 cars to Indonesia; offsets worth RM500m); delivery delayed from 1997 to 1999; CN-235-220 version"
18	South Korea	KIFV APC	1994	1994	21	X "Deal worth $13.2m; including 1 ARV, 1 APC/CP and 1 ambulance version"
19	Switzerland	MD-3-160 Aero Tiga Trainer aircraft	1993	1995	4	More produced for export and civil customers
20	Switzerland	MD-3-160 Aero Tiga Trainer aircraft	1993	1996	4	More produced for export and civil customers
21	Switzerland	MD-3-160 Aero Tiga Trainer aircraft	1993	1997	4	More produced for export and civil customers

Num	Country	Equipment	Ord	Delv	Num	Comments
22	Switzerland	MD-3-160 Aero Tiga Trainer aircraft	1993	1998	4	More produced for export and civil customers
23	Switzerland	MD-3-160 Aero Tiga Trainer aircraft	1993	1999	4	More produced for export and civil customers
24	Russia	AA-11 Archer/R-73 SRAAM	1994	1995	216	For MiG-29N FGA aircraft
25	Ukraine	AA-10a/b Alamo/R-27 BVRAAM	1994	1995	131	For MiG-29N FGA aircraft
26	USA	Newport Class Landing ship	1994	1995	1	"Ex US; deal worth $18.3m; Malaysian designation Sri Indrapura Class
27	UK	FH-70 Towed gun	1993	1994	3	
28	Italy	Assad Class Corvette	1995	1997	2	"Originally built for Iraq but embargoed; Malaysian designation Laksamana Class; deal worth $253m including 2 ordered 1997
29	South Korea	KIFV APC	1995	1995	47	"Deal worth $29.4m; including some CP versions"
30	USA	C-130H-30 Hercules Transport aircraft	1995	1995	5	
31	Italy	Aspide Mk-1 BVRAAM/SAM	1995	1997	18	For Assad Class corvettes
32	Italy	Otomat Mk-2 Anti-ship missile	1995	1998	4	For 2 Assad Class corvettes
33	Italy	Otomat Mk-2 Anti-ship missile	1995	1999	4	For 2 Assad Class corvettes

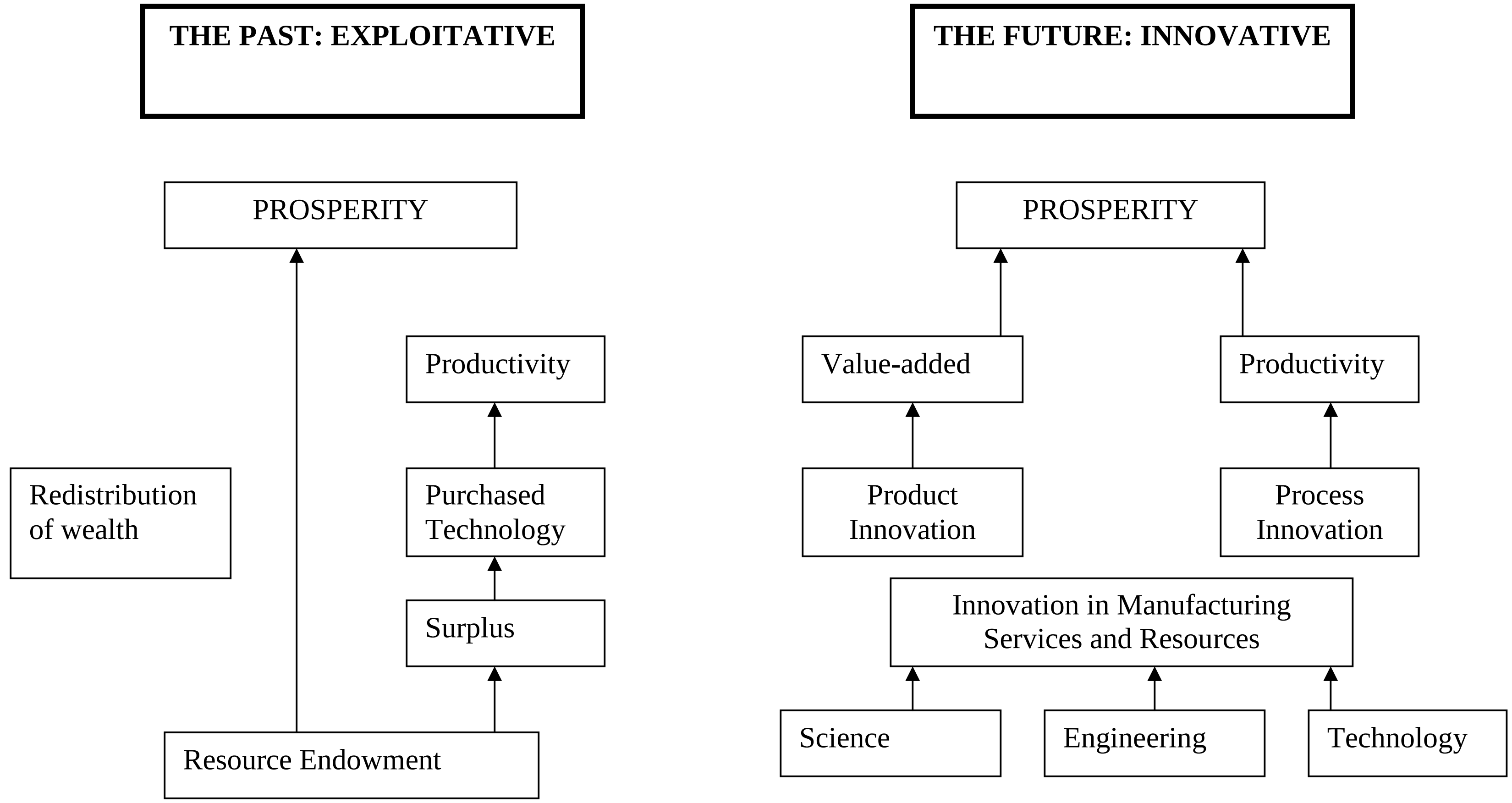
Num	Country	Equipment	Ord	Delv	Num	Comments
34	Italy	Otomat Mk-2 Anti-ship missile	1995	2000	16	For 2 Assad Class corvettes
35	Italy	Otomat Mk-2 Anti-ship missile	1997	2000	24	For 2 Assad Class corvettes
36	Italy	Aspide Mk-1 BVRAAM/SAM	1997	1999	18	For Assad Class corvettes
37	Turkey	AIFV IFV	2000	2002	15	"Deal worth $158m including 167 other versions; Malaysian designation Adnan; option on more"
38	Turkey	AIFV IFV	2000	2003	29	"Deal worth $158m including 167 other versions; Malaysian designation Adnan; option on more"
39	UK	Super Lynx ASW helicopter	1999	2002	2	"Deal worth $158m ; delivery 2002-2003"
40	South Africa	G-5 Towed gun	2000	2002	22	"Deal worth $50m; Mk-3 version"
41	France	Eryx Anti-tank missile	1995	1996	100	Including for use with Malaysian UN forces in Bosnia (UNPROFOR)
42	France	Eryx Anti-tank missile	1995	1997	100	Including for use with Malaysian UN forces in Bosnia (UNPROFOR)
43	Italy	RAT-31S Air surv radar	1996	1998	2	
44	Turkey	AIFV-APC APC	2000	2002	50	"Deal worth $278-300m including 44 IFV version; including ambulance, ALV, 81mm mortar carrier and CP version; assembly of 65 in Malaysia;

Num	Country	Equipment	Ord	Delv	Num	Comments
						Malaysian designation Adnan; option on more"
45	Turkey	AIFV-APC APC	2000	2003	117	"Deal worth $278-300m including 44 IFV version; including ambulance, ALV, 81mm mortar carrier and CP version; assembly of 65 in Malaysia; Malaysian designation Adnan; option on more"
46	Russia	Mi-17/Hip-H Helicopter	1999	1999	2	
47	Pakistan	HN-5A/Anza-1 Portable SAM	2001	2002	100	Deal worth $12.8m
48	Italy	A244/S 324mm ASW torpedo	1995	1997	16	For Assad (Laksamana) Class corvettes
49	Italy	A244/S 324mm ASW torpedo	1995	1998	16	For Assad (Laksamana) Class corvettes
50	Italy	A244/S 324mm ASW torpedo	1995	1999	16	For Assad (Laksamana) Class corvettes
51	Russia	AT-13 Saxhorn/9M131 Anti-tank missile	2001	2001	100	Deal worth $30m
52	Russia	AT-13 Saxhorn/9M131 Anti-tank missile	2001	2002	400	Deal worth $30m
53	Pakistan	Red Arrow-8 Anti tank missile	2001	2002	250	
54	Sweden	ARTHUR Arty locating radar	1999	2000	2	
55	UK	Sea Skua Anti-ship missile	2001	2002	48	

Num	Country	Equipment	Ord	Delv	Num	Comments
56	Russia	Mi-17/Hip-H Helicopter	2002	2002	10	
57	Switzerland	PC-7-2 Trainer aircraft	2000	2001	9	
58	France	Eryx Anti-tank missile	2000	2000	74	
59	Russia	N-019ME Topaz Combat ac radar	1999	2002	5	
60	Brazil	Astros-2 MRL	2000	2002	18	

Source: Ministry of Defence, Malaysia, Kuala Lumpur, 2005

Appendix B: Malaysia’s Route to National Prosperity



Source: Ahmad Sarji Abdul Hamid (Ed), ***Malaysia’s Vision 2020: Understanding the Concept, Implications and Challenges*****, KL: Pelanduk Publication, 1993, pp.279.**

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Appendix C: List of Offsets Programmes, by Beneficiary

No	Beneficiary	Procurement	Date/Year	Seller
1	SME Aerospace	Hawk Aircraft Starburst Missile F/A 18 Vertical launch Seawolf missile Super Lynx Helicopter S-70 Blackhawk VVIP C-130 Pilatus PC-7 MKII	10 Dec 1990 24 Jan 1993 28 Oct 1993 3 Dec 1993 2 Sept 1999 4 Oct 1996 13 Sept 1996 21 Sept 2000	British Aerospace Short Brothers PLC Mc Donnel Douglas Corp British Defence Dynamics GKN Westland Helicopters Lit Sikorsky Lockheed Corp Pilatus Aircraft Ltd. Switzerland
2	Royal Malaysian Airforce (RMAF)	Hawk Aircraft F/A 18D S-70A Blackhawk VVIP	10 Dec 1990 28 Oct 1993 4 Oct 1996	British aerospace McDonnel Douglas Sikorsky
3	SME Technologies	Hawk Aircraft	10 Dec 1990	British Aerospace

No	Beneficiary	Procurement	Date/Year	Seller
		Exocet Missile S-70A Blackhawk VVIP MLRS (ASTROS II)	12 Oct 1993 4 Oct 1996 24 Nov 2000	Aerospatiale Sikorsky Avibras Industria Aerospacial Int.Ltd
4	Sime Aircraft Tyres	Hawk Aircraft MIG 29	10 Dec 1990 7 June 1994	British Aerospace Rosvoorouzhenie &Moscow Aircraft
5	University Technology Malaysia	Hawk Aircraft Frigate Starburst Missile Exocet missile F/A 18D S-70A Blackhawk VVIP MLRS (ASTROS II)	10 Dec 1990 31 Mac 1992 24 Jan 1993 12 Oct 1993 28 Oct 1993 4 Oct 1996 24 Nov 2000	British Aerospace GEC Marconi Ltd Short brothers PLC Aerospatiale McDonnel Douglas Sikorsky Avibras
6	SME Ordnance	Hawk Aircraft Starburst Missile MLRS (ASTROS II)	10 Dec 1990 24 Jan 1993 24 Nov 2000	British Aerospace Short Brothers PLC Avibras
7	University Utara	Hawk Aircraft	10 Dec 1990	British Aerospace

No	Beneficiary	Procurement	Date/Year	Seller
	Malaysia(UUM)			
8	AIROD	Hawk Aircraft Beechcraft C-130 Ecureuial AS 355N Helicopters Super Lynx Helicopter F/A 18D Pilatus PC-7 MKII	10 Dec 1990 20 May 1992 13 Sept 1996 27 Oct 1995 2 Sept 1999 28 Oct 1993 21 Sept 2000	British Aerospace Hawker Pacific Ltd Lockheed Corp Euroaircraft Services GKN Westland McDonnel Douglas Pilatus Aircraft Ltd
9	Dept of Civil Aviation (DCA)	Hawk Aircarft F/A 18D Starburst Missile Vertical Launch Seawolf Missile	10 Dec 1990 28 Oct 1993 24 Jan 1993 3 Dec 1993	British Aerospace McDonnel Douglas Short Brothers PLC British Aerospace
10	SME Aviation	Hawk Aircraft F/A 18D	10 Dec 1990 26 Oct 1993	British Aerospace McDonnel Douglas
11	Royal Malaysian Navy(RMN)	Frigate Torpedo Exocet missile Corvette	31 Mac 1992 2 Jun 1993 12 Oct 1993 26 Oct 1995	GEC-Marconi Ltd Whitehead S.P.A Aerospatiale Fincantieri-Cantier

No	Beneficiary	Procurement	Date/Year	Seller
				Navali Italiani
12	PSC-NDSB	Frigate Exocet Missile Corvete Petrol Vessel	31 Mac 1992 12 Oct 1993 26 Oct 1995 2001	GEC-Marconi Ltd Aerospatiale Fincantieri-Cantier GNG Germany
13	STRIDE	Frigate Starburst Missile Torpedo Exocet Missile F/A 18D KIFv(2nd –purchase) Eyrx Weapon System KIFv(3nd –purchase) C-130 Corvette Otomat and Aspida Missiles S-70A Blackhawk VVIP Super Lynx Helicopter MLRS Astros II	31 Mac 1992 24 Jan 1993 2 Jun 1993 12 Oct 1993 28 Oct 1993 26 Oct 1993 20 Jan 1995 26 Oct 1993 13 Sept 1996 26 Oct 1995 9 Feb 1996 4 Oct 1996 2 Sept 1999 24 Nov 2000	GEC Marconi Short Brothers PLC Whitehead S.P.A Aerospatiale McDonnel Douglas Daewoo Corp Aerospatiale Daewoo Corp Lockheed Corp Fincantieri-Cantier Oto Melara S.P.A Sikorsky GKN-Westland Avibras Industrial

No	Beneficiary	Procurement	Date/Year	Seller
14	Sapura Technologies	Hawk Simulator	19 Jun 1992	Reddifussion Simulation Ltd
15	CTRM	Starburst Missile Vertical Launch Seawolf Missile Super Lynx Helicopter C-130	24 Jan 1993 3 Dec 1993 2 Sept 1999 13 Sept 1996	Short Brothers PLC British Defence Dynamics GKN-Westland Lockheed Corp
16	MMC Engineering	KIFv (1st purchase)	26 Oct 1993	Daewoo corp
17	SIRIM	F/A 18D	28 Oct 1993	McDonnel Douglas
18	PHN Industries	F/A 18D	28 Oct 1993	McDonnel Douglas
19	PROTON	F/A 18D	28 Oct 1993	McDonnel Douglas
20	MOSTE	F/A 18D	28 Oct 1993	McDonnel Douglas
21	Serampang Hughes	F/A 18D	28 Oct 1993	McDonnel Douglas

No	Beneficiary	Procurement	Date/Year	Seller
22	PERODUA	F/A 18D	28 Oct 1993	McDonnel Douglas
23	UIA	F/A 18D	28 Oct 1993	McDonnel Douglas
24	ATSC	F/A 18D	28 Oct 1993	McDonnel Douglas
25	USM	MIG 29	7 Jun 1994	Roosvoorouzhenie &Moscow Aircraft
26	ANCOM Energy	MIG 29	7 Jun 1994	Roosvoorouzhenie &Moscow Aircraft
27	Royal Malaysian Army (RMA)	KIFv (2nd purchase)	26 Oct 1993	Daewoo Corp
28	Malaysian Airlines System (MAS)	C-130	26 Oct 1993	Lockheed Corp
29	University Malaya(UM)	C-130	26 Oct 1993	Lockheed Corp
30	Marconi Malaysia	Corvette	26 Oct 1995	Fincantieri-Cantier

No	Beneficiary	Procurement	Date/Year	Seller
31	Comlenia	Corvette	26 Oct 1995	Fincantieri-Cantier
32	Zetro	Corvette Super Lynx Helicopter	26 Oct 1995 2 Sept 1999	Fincantieri-Cantier GKN-Westland
33	ME&O Fleet Support	Corvette Super Lynx Helicopter	26 Oct 1995 2 Sept 1999	Fincantieri-Cantier GKN-Westland
34	Comintel Sdn Bhd	Corvette	26 Oct 1995	Fincantieri-Cantier
35	System Consultancy Services	Corvette PSR Radar	26 Oct 1995 10 July 1996	Fincantieri-Cantier Alenia
36	Sigma-Xi Engineering	Corvette	26 Oct 1995	Fincantieri-Cantier
37	Sapura Thompson	Frequency Hopping Manpack & Vehicular Transceivers	17 Oct 1997	Thompson-CSF Comm, France
38	Defence Technology	Electronics Support Measures	14 Jan 1999	Thomson-CSF RCM

No	Beneficiary	Procurement	Date/Year	Seller
	&System Sdn Bhd			
39	Safrimas Sdn Bhd	IBIS Minehunting System	8 Apr 1999	Altech Defence System, South Africa
40	RMS Technologies Sdn Bhd	Artillery Location Radar	16 Apr 1999	Ericson Microwave System Ab Sweeden
41	Sapura Advanced System Sdn Bhd	Super Lynx Helicopter	2 Sept 1999	GKN-Westland
42	DMIB Berhad Sdn Bhd	155m,45 Calibre, G5 MKIII Gun System MLRS (ASTROS II)	22 Nov 2000 24 Nov 2000	Denel (Pty) Ltd, South Africa Avibras Industrial Aerospatiale
43	Yuasa Power System	155m,45 Calibre, G5 MKIII Gun System	22 Nov 2000	Denel (Pty) Ltd, South Africa
44	Pesaka Astana(M) Sdn Bhd	155m,45 Calibre, G5 MKIII Gun System	22 Nov 2000	Denel (Pty) Ltd, South Africa
45	Malaysia Optronic Systems	155m,45 Calibre, G5 MKIII Gun System	22 Nov 2000	Denel (Pty) Ltd, South

No	Beneficiary	Procurement	Date/Year	Seller
	Sdn Bhd			Africa
46	DEFTECH-DRB HICOM Defence technologies Sdn Bhd	Armoured Infantry Fighting	May 2000	FNSS Savunma Sistemleri A.S, Turkey
47	Simex Tyres, Silverstone Bhd	MLRS (ASTROS II)	24 Nov 2000	Avibras Industrial Arospacial
48	Rubber Metal Technic Sdn Bhd	MLRS (ASTROS II)	24 Nov 2000	Avibras Industrial Arospacial
49	Watta Batteries Industries Sdn Bhd	MLRS (ASTROS II)	24 Nov 2000	Avibras Industrial Arospacial
50	Metro Koats Technology (MKT)	MLRS (ASTROS II)	24 Nov 2000	Avibras Industrial Arospacial
51	Tenaga Kimia Bhd -Mastra Corp Sdn Bhd -Felda Agricultural Services Sdn Bhd	MLRS (ASTROS II)	24 Nov 2000	Avibras Industrial Arospacial
52	Arrow Components (M) Sdn	MLRS (ASTROS II)	24 Nov 2000	Avibras Industrial

No	Beneficiary	Procurement	Date/Year	Seller
	Bhd			Arospacial
53	Delteq (M) Sdn Bhd -Comwise Interwork sdn Bhd -CompAsia superstore Sdn Bhd -Alphamatic Systems Sdn Bhd -Aliran Permata Sdn Bhd -Business Network Solutions Sdn Bhd -Dataware Sdn Bhd	MLRS (ASTROS II)	24 Nov 2000	Avibras Industrial Arospacial
54	Betton Tools Sdn Bhd -Hes Wilayah Sdn Bhd -W.K.C Enterprise	MLRS (ASTROS II)	24 Nov 2000	Avibras Industrial Arospacial

Source:

Malaysian Industry Group for High Technology (MIGHT), *A Study on Offsets Programme of the National Defence Procurement*, Putra Jaya, November, 2001.

Appendix D: List of Companies Surveyed and Nature of Business

Num	Company	Sector	Nature of Business	Location
1	Airods	Aerospace	• Aircraft Maintenance, Modification and Upgrades, • Engines & Component Repair and Overhaul, • Aero Components Repair and Overhaul, • Avionics Components Repair and Calibration. • Avionics Components Repair and Calibration. • Manufacturing of Portable Minefield Lighting System	Locked Bag 4004 Pejabat Pos Kampung Tunku 47309 Petaling Jaya
2	CTRM	Aerospace	• Eagle 150B	TO2, 3rd. Floor 2310, Century Square, Jalan

Num	Company	Sector	Nature of Business	Location
			• Two seater, all composite, GA aircraft with a cruise speed of 125 knots • Lancair Columbia 300 • Four seater, all-composite, GA aircraft • Eagle ARV System AEROSPACE SERVICES • Research & development • Design & Engineering services • Manufacturing • Assembly • Testing • Certification	Usahawan, 63000 Cyberjaya. Facilities in Malacca
3	SME Aerospace	Aerospace	-Aerospace ground support equipment; • Air-borne ordnance and parts (including training rockets & bombs); • Machining and assembly; • Hydraulic actuators; • Sheet metal fabrication services;	Lot 14643, Locked Bag No 222 47000 Sungai Buloh Selangor

Num	Company	Sector	Nature of Business	Location
			• Welding services.	
4	Zetro Services Sdn Bhd	Aerospace	Design, fabrication, overhaul, repair, calibration, upgrading and maintenance of avionics components systems for all aircrafts in RMAF. Design, fabrication, overhaul, repair, calibration and maintenance of all ground electronic equipment/systems in the RMAF including total maintenance of Air Traffic Control Equipment and Systems. Repair and Overhaul of Army Artillery Electronic Equipment & Systems and Communication Equipment & Systems for the Royal Malaysian Police and the Oil & Gas Industry. Design, Installation, Integration and Commissioning of radar systems for air defence, air traffic control and maritime surveillance	KL International Airport Berhad Block 7, Jalan KLIA 1/70 64000 Sepang Selangor
5.	Hong-Leong-Lurssen Shipyard (1992) Sdn Bhd	Maritime	Building, repairing and overhauling of naval ships and patrol craft.	4567, Jalan Chain Ferry P. O. Box 43 12700 Butterworth, Pulau Pinang.
6.	Malaysia Shipyard & Engineering Sdn Bhd	Maritime	Ship repair, shipbuilding and heavy engineering -works for onshore and offshore projects. Other support services are: -	P.O. Box 77, 81707 Pasir Gudang Johor Darul Takzim

Num	Company	Sector	Nature of Business	Location
			1) Processed copper blasting grit 2) Oil sludge treatment plant 3) Tugs and towage services	
7	ME & O Fleet Support Sdn Bhd	Maritime	Inventory control and management system/Bar coding; Lighting protection system ship preservation system.	No.9, Jalan SS7/10 Kelana Jaya 47301 Petaling Jaya Selangor Darul Ehsan
8	PSC - Naval Dockyard Sdn Bhd (taken over by Bousted Group as of September 2005)	Maritime	• Dockyard services and-engineering services - mechanical / electrical • engineering, hull and docking services, electronic and weapon system • Specializes in complete overhaul, upgrading and maintenance of medium calibre canons, naval-gun, artillery equipment and its associated systems. • Universal tests electronic defence industry especially in the field of combat, command and control system.	PSC-Naval Dockyard Sdn.Bhd Royal Malaysian Navy Base 32100 Lumut, Perak
9	Sigma Xi Engineering Sdn Bhd	Maritime	Maintenance of naval communication equipment integration of communication and weapon systems.	No. 4113, Jalan Tun Mohd Fuad 3, Taman Tun Dr. Ismail 60000 Kuala Lumpur
10	SME Ordnance Sdn Bhd	Weapons	Manufacturing of:	Lot 5065 Locked Bag No. 101

Num	Company	Sector	Nature of Business	Location
			Small Arms Ammunition:- - 5.56 mm Ball M193 (Loose/Link) - 5.56 mm Tracer M196 - 5.56 mm Ball M855/SS109 - 5.56 mm Blanks (Long Nose) - 5.56 mm Blanks M200 - 7.62 mm Ball (All Natures) - 7.62 mm - Link Belt 4 (BIT) - 9 mm. Ball (Luger / Parabellum) - .38 Special (Lead Round Nose) • Medium Calibre Ammunition - 12.7 mm APIH / IT, - 20 mm Oerlikon HEI-T - 30 mm ADEN TP - 25 mm all types - 35 mm all types • Shotgun Cartidges - 12 Gauge Shotgun Cartridge (various type) • Pyrotechnics & Grenades - Coloured Smoke Grenades All Colour - Mini Flares (set of six) - Wire Tripflares - Day & Night Signal Distress - Ground Illuminating Flares - Aviation Smoke Generator - Signal Cartridges 1"/26.5 m	48109 Batu Arang Selangor Darul Ehsan

Num	Company	Sector	Nature of Business	Location
			- Signal Cartridges 1 1/2"/38 mm - Cart. C.S. Anti Riot 38 mm - Grenade Hand C.S Anti Riot - Grenade Hand High Explosives - Detonating Cord - Electric Detonator - Non Electric Detonator - Safety Fuze (per meter) - Handflare Red Para - Thunderflash • Large Calibre Ammunition - Mortar Bombs 81 & 60 mm - Rounds 40 mm L70 HEI-T - Rounds 105 mm HE MI - Mortar Bombs 81 mm HE 71 b - Rounds 40 L70 TP-T - Rounds 57 mm L70 TP - Cartidges 105 mm Blank PH - Scare Charge Demolition TNT 1 lb - Charge Demolition 10 lbs and 25 lbs - Cast Booster 250g TK 1 and 500g TK2 - Round 90 mm HE-T - Round 90 mm HESH-T - Round 90 mm HEAT-T - Round 90 mm HEAT-TP-T - 84 mm HEAT 551 - Rd 76 mm TP-T	

Num	Company	Sector	Nature of Business	Location
			- Rd 155 mm HE M107 • Weapon - Steyr AUG A1 Rifle, Mess Tin Complete, Water Bottle Complete • Engineering Plastic Division (EPD) • Defence Related - Steyr AUG Rifle Butt and Other Components - PPC Canister for ammunition 105 mm, 40mm L70, 81 mm Mortar, Toilet seat • Metal Boxes - M2A1, BG - 69/M61, H84, 9 mm, M548, A125	
11	DRB-Hicom Defence Technologies Sdn Bhd	Automotive	-A flexible manufacturing plant for the assembly of armoured vehicles (wheeled and tracked) of up to 50-ton Main Battle Tank as well as for system integration of specialist vehicles. • A workshop for the repair (including base overhaul), maintenance and refurbishment of soft-skin and armoured vehicles. • A warehouse with the requisite facilities for the stocking and distribution of spare parts nationwide.	57th Floor Empire Tower City Square Centre 182, Jalan Tun Razak 50400 Kuala Lumpur Facilities in Pekan, Pahang

Num	Company	Sector	Nature of Business	Location
			• A computerised materials resources planning system (MRP) for production and control planning and inventory management. • A NATO standard vehicle test track in close proximately to the plant.	
12	MMC Defence Sdn Bhd	Automotive	• Base maintenance, refurbishment, upgrade and Research & Development works for armoured vehicle variants, both track as well as wheeled vehicles. • Expertise in turret and gun system (20mm and 90mm)	Lot 1479, B10, Kawasan Perindustrian Nilai, 71800 Nilai, Negeri Sembilan Darul Khusus Malaysia
13	Pesaka Astana (M) Sdn Bhd	Automotive	• Manufacturer of Customised and specialised vehicle Military truck, Fire & Rescue Vehicle, Medium and Heavy Recovery Vehicle, Port Terminal Tractors • Manufacturing truck and total after sales services	No. 3 Jalan Utarid U5/1 (PS) Seksyen U5 40150 Shah Alam Selangor
14	Scomi	Automotive	-Manufacturing and fabricating of quality road transport hardware. Providing related engineering	Lot 519, Jalan TUDM Kampong Baru Subang

Num	Company	Sector	Nature of Business	Location
			services and distribution of transportation related equipment. -Articulated Vehicles Tankers (Pressurised/Non Pressurised) • Aluminum tankers (petroleum products) • Mild steer tanker (palm oil, latex, diesel etc) • Stainless steel tank • Liquefied petroleum gas (LPG) • Chemicals • Flour/feed • Cement Trailer • Cargo semi trailers • Car carriers • Container trailers • Low loaders • Telescopic pole trailers • Box van trailers • Port trailers • Tipping trailers • Curtain side trailers Truck Mounted Vehicles • Water tankers • Refuse compactors • Roll on roll off mechanism (arm roll) • Sewer cleaner	P.O. Box 7299 40710 Shah Alam Selangor

Num	Company	Sector	Nature of Business	Location
			• Tipper • Aerial platform • Refrigeration body • Vacuum tankers <u>Airport Ground Handling Equipment</u> • Aircraft refuellers • Hydrant dispensers • Passenger steps • Toilet/water servicing trucks • Belt loaders <u>Utility Vehicles</u> • Aerial hydraulic platforms • Towing and recovery vehicles • Crane augers <u>Others</u> • Beach cleaners • Tail lift • Hydraulic cranes • Road sweepers • Wood chippers • Incinerator/cremator • Compressor • Port tractors • Military support vehicles • Ambulance • Mobile dental clinics	

Num	Company	Sector	Nature of Business	Location
			• Mobile clinic • Hearse body Related Engineering Services • Consultation, designing, problems solving, parts repairs and training in specialised transportation engineering field.	
15	Caidmark	ICT	For military-Focus in Condition Based Maintenance (CBM). ECMS, which is a general-purpose database system, designed to track the location, configuration, life usage status, and condition and maintenance history of serialized aircraft components. ECMS covers both engine and structural components and is applicable to naval and Fort OGP sectors – Caidmark's emphasis will be in providing solutions in reliability engineering. Plant Information Management System, CBM, Reliability Centred Maintenance (RCM) and expert system based framework for the side wide deployment of reliability and operation management application. Intelligent Building Management System	53, Jalan SS21/56B Damansara Utama 47400 Petaling Jaya

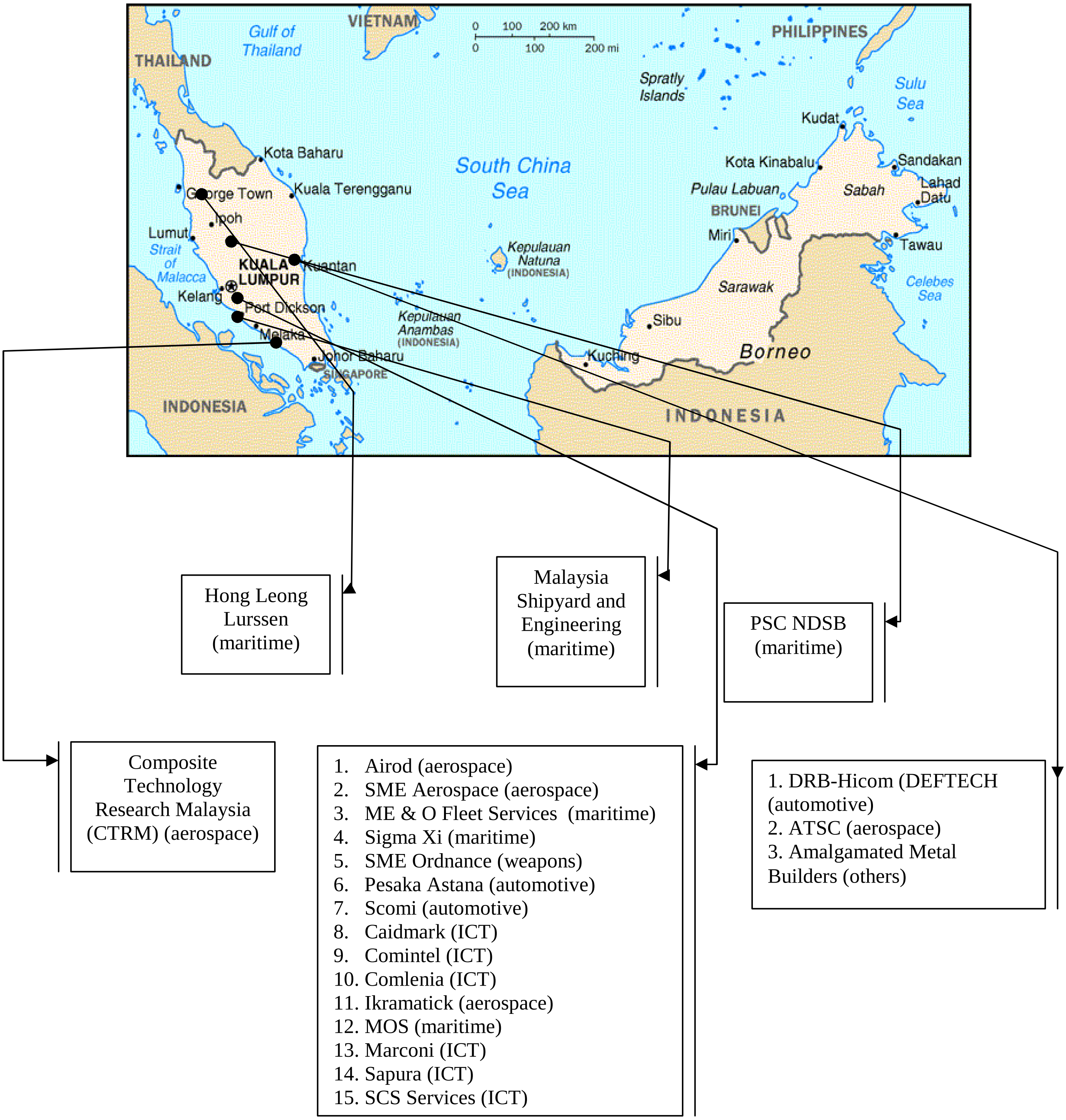
Num	Company	Sector	Nature of Business	Location
16	Comlenia	ICT	Integrated logistics support, electronic systems, repairing and testing including combat systems upgrading activities. Capable of 3rd level repair and testing for all ranges of electronic cards from analog, digital and IF/RF using latest state of the art, fully computerised Automatic Test Equipment.	Comlenia Sdn Bhd 12, Jalan PJS7/21 Bandar Sunway 46150 Petaling Jaya Selangor
17	IKramatic Systems Sdn Bhd	ICT	Simulation technology provider. Specialising in cost-effective Flight Simulator including: Fixed-wing type and Helicopters. Develop Computer Assisted Training Systems for aircrew and ground support person	No.45, Jalan Juruanalisis U1/35 Hicom-Glenmerie Industrial Park 40150 Shah Alam Selangor
18	Malaysian Optronic Systems Sdn Bhd	ICT	Assembling of laser range finder, night vision binoculars and optical sighting devices Upgrading of laser range finder, night vision device to suit user requirement.	No. 4, Ground Floor, UM-MTDC Technology Innovation CTR Universiti Malaya 50603 Kuala Lumpur
19	Sapura Technologies Sdn Bhd	ICT	Design, manufacture, integrate, supply and maintain communications products and systems • Design, develop, integrate and maintain flight, maritime, land-based and radar simulators – provides computer-based training that utilises	Sapura @ Mines No. 7, Jalan Tasik The Mines Resort City 43300 Seri Kembangan

Num	Company	Sector	Nature of Business	Location
			web-based technologies for the Armed Forces • Marketing, supply, operate and maintain various radar and air traffic management systems • Performs various maritime business activities especially in electronic and training • Development of Electronis Warfare system pertaining to EW Support System • Full range of services to support MalaysianArmed Forces non-core activities such as marketing and supply of firearms Training Systems and development & integration of computerised logistics management system	
20	System Consultancy Services Sdn Bhd	ICT	Specialising in consultancy in ICT, development and integration of Command, control, Communication and Intelligence (C31) system as well as Information Warfare System with particular emphasis on Electronic Warfare system. Scada Systems, Industrial and Process Automation Solutions, Buildings Security Solutions and Fiber Glass Composite products manufacturing.	36, Jalan 1/27F Pusat Bandar Wangsa Maju (KLSC) 53300 Kuala Lumpur
21	Amalgamated Metal Builders (M) Sdn Bhd	Common users	Providing engineering services and support : • Steel fabrications	Lot 74-A Gebeng Industrial Area 26080 Kuantan

Num	Company	Sector	Nature of Business	Location
			• Installation and commissioning of plant • Civil & structural works • Maintenance services Products Vessels, Shell & Tube Heat Exchangers, Reactors, Towers/Columns, Casting Ladles, Loading Arms, Flare Stack, Piping Works and other steel fabricated products.	Pahang

Source: Ministry of Defence, Malaysia, *List of Malaysian Defence Industry Council Members*,[Online], (Accessed: 12 July 2005), Avaliable at: http://www.mdic.gov.my

Appendix E: Geographical Distribution of Malaysian Defence Companies Included In The Survey



Source: Author

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Appendix F

To Whom It May Concern

PhD Research to Evaluate the Effectiveness of Defence Offsets in Malaysia

Do offsets really work? This question has loomed large in the minds of practitioners and academics in the defence sphere. Offsets have today become synonymous with the process of arms procurement. Despite the importance of offsets and the huge volumes of money involved, there has been minimal empirical research to examine the effectiveness of offsets. There is a huge gap in this area of research and certainly needs further analysis.

Miss Kogila Balakrishnan, a PhD student at Cranfield University, is pursuing her research on the effectiveness of offsets. As background, Kogila has served in the Defence Industry Division, Ministry of Defence, and Malaysia since 2000. With her core responsibility at the ministry encompassing coordinating, negotiating and monitoring the implementation of offsets, it was logical to base her PhD research work on her Defence experience. Kogila has therefore embarked on a programme to **Examine the Impact of Offsets on Malaysia's industrial and technological development.**

The objectives of the research are to:

ix. illustrate and evaluate the various offset models, frameworks, tools, processes and mechanisms by cross reference to offset practices in other selected developed and developing countries;

x. critically analyse Malaysia's current offset policy, processes, problems and strategies by applying SWOT analysis and other appropriate business models.

xi. determine the factors that contribute towards an 'effective' offset strategy;

xii. evaluate industrial and technological progress achieved through offset-induced technology transfer.

xiii. propose strategic approaches and make policy recommendations towards an effective offset model enabling offsets to play a more robust role in meeting Malaysia's industrial and technological development needs.

In order to carry out her research successfully, the presenter intends to send out questionnaires to selected offsets beneficiaries in Malaysia. She also intends to interview relevant persons in defence agencies, Original Equipment Manufacturers and offsets related-organisations. The aim is to gather sufficient evidence to support research and compile the findings into a PhD thesis that will address the overarching issues of defence offsets in development of both defence and civil infrastructure.

Cranfield University fully supports Kogila's research. It is considered that the research findings will be beneficial in further enhancing the negotiation and design of offsets policy. At the same time, the issues raised through this research will also make valuable contribution to the defence community in evaluating the future of offsets.

It would therefore be appreciated if your organisation would provide appropriate assistance and cooperation to Kogila during the research phase of her studies.

Thank You

Professor Ron Matthews
Academic Leader
MDA Programme
Royal Military College of Science
Cranfield University

To Whom It May Concern

February 2005

PhD Research Project: **Examining the Impact of Offsets on Malaysia's Industrial and Technological Development**

Miss Kogila Balakrishnan, who served the Defence Industry Division, Ministry of Defence, Malaysia until 2003 is presently on a three year study leave pursuing PhD at the Cranfield University, Defence Academy, UK. She is now embarking on her fieldwork activities, seeking data from Malaysia's defence-related companies.

As the Ministry has a special interest in monitoring the progress of offsets programmes in Malaysia, her research will certainly be of interest to us. With this in mind, the Ministry fully supports Miss Kogila's PhD research **Examining the Effectiveness of Offsets in Malaysia.** I believe this research will be helpful in further enhancing the country's future offsets policy and strategy.

I sincerely hope that you will give your fullest support and cooperation in making this research a success.

Thank You

Datuk Subhan Jasmon
Secretary General
Ministry of Defence
Malaysia

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Questionnaire

EXAMINING THE EFFECTIVENESS OF DEFENCE OFFSETS IN MALAYSIA

Aim of the Questionnaire

This questionnaire is designed to gather evidence as to the effectiveness of defence offsets as a mechanism to facilitate industrial and technological development in Malaysia. The questionnaire is part of a PhD research programme. The outcome of this research will be utilised to further assist the Government of Malaysia in enhancing its national offsets policy and strategy for the development of Malaysian companies.

This questionnaire is directed to managers and engineers who have been involved in offsets programmes. Your expert opinion is essential in assessing offset and technology transfer issues that are important to the Government of Malaysia. Thank you for completing this questionnaire. Please note that the name of your company will not be mentioned in the report. Your cooperation is appreciated.

Instruction

Many of the responses in this questionnaire sample require a tick in a box ☑

However, some questions will ask for your written comments, detailing your insight into a particular topic.

Sections covered in this questionnaire

PART A	:	Company Profile
PART B	:	Company Operations, Strategy and Human Resource Development
PART C	:	Technology development Capability
PART D	:	Technology Transfer through Offsets/Others
PART E	:	Offsets Programme Impact/Others
PART F	:	Offsets Implementation
PART G	:	Final Suggestions
ANNEXURE	:	Offsets programme Profile/Others

Please complete all questions according to the guidelines provided

PART A: COMPANY PROFILE

1.01 Company name:

1.02 Address:

1.03 Contact Person:

1.04 Designation:

1.05 Date Start Operation :

1.06 Type of Business (please tick one): ☑

a. Individual proprietorship ❒

b. Public limited company ❒

c. Private limited company ❒

d. Co-Operative ❒

1.07 Paid-Up Capital:

1.08 Annual Turnover (for the last five years)

2000	2001	2002	2003	2004

1.09. Profit (for the last five years):

2000	2001	2002	2003	2004

1.10 Ownership of the Business in terms of paid-up capital (should add up to 100%)

<table>
<tr><th colspan="2">Group</th><th colspan="2">Ownership</th></tr>
<tr><td rowspan="2">Local</td><td>Privately-owned</td><td rowspan="2">Amount</td><td rowspan="2">Percentage
100%</td></tr>
<tr><td>Govt-owned</td></tr>
<tr><td>Foreign</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td></td><td></td><td></td></tr>
</table>

PART B: COMPANY OPERATION, STRATEGY AND HUMAN RESOURCE DEVELOPMENT

Please note that all questions in this section are about your firm (including your branch or subsidiary)

2.01 Which of the following best describes your company? (tick all that apply) ☑

- Plant production ❒
- Maintenance, Repair and Overhaul (MRO) ❒
- Upgrade/Retrofit ❒
- Management ❒
- Accounting ❒
- Sales Office ❒
- Others ❒

2.02 Number of Employees in your company: (please tick the appropriate box) ☑

- Under 250 ❒
- 250-500 ❒
- 500-1000 ❒
- More than 1000 ❒

2.03 Please estimate the proportions of your company's workforce according to level of education attained. Please include all levels of workers:

Less than primary school.	%
Secondary school	%
High school completed	%
Vocational school completed	%
University degree completed	%
Total number of workers	%

2.04 Approximate percentage of employees in your company involved in:

Management	%
Operation	%
Maintenance	%
Research and Development	%
Total	%

2.05 Your company's annual expenditure on management training and skill development as a percentage of revenues(please tick the appropriate box)

Less than 10% ❒ 21-30% ❒ 41-50% ❒

11-20% ❒ 31-40% ❒ Greater than 51% ❒

2.06 For each of the following categories, please rate your company's position versus other companies: (please tick in the right column)

	Behind other local companies	**Similar to other local companies**	**Equal to the best in the region**	**Equal to the best in the world**
Product design and quality				
Manufacturing Process				
Assembly				
MRO process				
Through life support				
Systems integration				
Safety				
Management strategy				
Technology				
Skilled workers				

	Behind other local companies	**Similar to other local companies**	**Equal to the best in the region**	**Equal to the best in the world**
Services offered				
Export potential				
Marketing strategy				

2.07 Your company's competitive strategy in its principal business is (choose the most applicable answer)

Based on natural resources availability ❒

Based on favourable costs of skilled workers ❒

Based on product or process technology ❒

Based on marketing strategy ❒

Based on the infrastructure support ❒

2.08 Your company's broad industry category (based on the MDIC classification)

- Aerospace ❒
- Maritime ❒
- Weapon ❒
- ICT ❒
- Automotive ❒
- Others (please specify) ❒

PART C: COMPANY TECHNOLOGY DEVELOPMENT CAPABILITY

3.01 Your company's annual expenditure on developing new technology as a percentage of revenue

Less than 10%	❒	21-30%	❒	41-50%	❒
11-20%	❒	31-40%	❒	Greater than 51%	❒

3.02 Your company's annual R&D expenditure as a percentage of revenue

Less than 10%	❒	21-30%	❒	41-50%	❒
11-20%	❒	31-40%	❒	Greater than 51%	❒

3.03 Does your company have R &D facilities?

Yes ❒ No ❒

If no, please indicate the reasons

…………………………………………………………………………………….

…………………………………………………………………………………….

3.04 Does your company collaborate with scientific research institutions (such as SIRIM, USM, UTM, STRIDE, MINDEF and others)?

Yes ❒ No ❒

If yes, please specify which organisation and details of collaboration:

Organisation	**Details of the project**

3.05. Does your company receive R & D assistance from government?

Yes ❒ No ❒

If yes, please provide details of the assistance:

……………………………………………………………………….…………………

3.06. Does your company receive Government R&D tax credits:

Yes ❒ No ❒

If yes, please specify the details:

………………………………………………………………………………

3.07 Does your company source the following? (tick the appropriate box):

	Local	**Foreign**	**Both**	**Specify the sources**
Technology				
Components and Parts				
Machinery				
Specialised Research and Training Services				
Consultancy services				
Raw materials for maintenance				
Skilled workers				

3.08 Does your company have any patent registrations?

Yes ❒ No ❒ Total number ☐

If yes, please give details and indicate when acquired, where the registration is lodged and the nature of the technology patented.

Source of patent	When acquired	Where registration lodged	Nature of technology

PART D: TECHNOLOGY TRANSFER THROUGH OFFSET/ OR OTHERS (PLEASE SPECIFY)

(For the purpose of this survey, technology includes hard and soft technology. Hard technology includes machinery, tools, jig, other hardware and techniques. Soft technology includes manuals, training, know-how, attachment, foreign consultancy services and conference).

4.01 In the last five years, did your company introduce a new product, service or production method?

Yes ❒ No ❒

.4.02 If yes, this innovation originated from:

Within the firm ❒

Another source in your country ❒

Another country ❒

4.03 If an innovation has come from another country, how was it transferred? (Tick all applicable boxes)

- Bilateral arrangement ❒
- Technical Cooperation ❒
- Offsets ❒
- Joint Venture ❒
- Turnkey contracts ❒
- Foreign Direct Investment ❒
- Others (please specify) ❒

4.04 Please specify the country engaged in the highest level of offsets, whether licensed, joint venture, co-production, collaboration or others:

Country	**Joint venture**	**Co-Production**	**Sub-Contract**	**Collaboration**	**Other**
USA					
Britain					
France					
Italy					
Other EU					
Other specify)_					

4.05 To what extent do you agree with the following statements (please tick)?

i. Was the technology transferred through offsets readily available from several other sources in the world

Yes ❒ No ❒

ii. The technology has narrow applicability to the specific defence system produced by your company

Yes ❒ No ❒

4.06 Transfer of technology through offsets has resulted in the following (please tick all applicable categories listing them in order of priority):

Num	Activity	Yes	No	Number (According to priority)
1	Patents			
2	Licenses			
3	Machinery			
4.	Education			
5.	Training			
6.	Turnkey projects			
7.	Employment of foreign consultants			
8.	Management participation			
9.	Technical assistance			
10.	Direct Foreign Investment			
11.	Know-how			
12.	Joint Ventures			
13.	Collaboration			
14.	Subcontracting			
15.	Co-Production			
16.	Buy-back arrangements			
17.	Built, Operate, Transfer (BOT)			
18.	Others (please specify)			

4.07 In your company, does offsets transfer the following types of technology (tick and number them in order of most importance)?

Type of Technology	Yes	No	Number	Specify details
Product technology				
Process technology				
Production Know-How				
Management Techniques				
Others				

4.08 Have you used the technology, or know-how, gained through offsets to develop technology locally?

Yes ❒ No ❒

4.09 If yes, please give examples and indicate the source responsible and what type of work was undertaken

Source responsible	Type of work undertaken

4.10 Has your firm faced any offset-related technology problems in production or operation?

Yes ❒ No ❒

If yes, please give example and indicate the problems:

Problems	Examples

4.11 Has your company experienced any major technology-sharing problems with a foreign partner?

Yes ❒ No ❒

If yes, please give example and indicate the problems:

Problems	Examples

4.12 Has your firm experienced difficulties with the government sector in technology acquisition?

Yes ❒ No ❒

If yes, please give example and indicate the difficulty faced

Difficulty faced	Examples

4.13 Are you planning, to independently market the products, technology or know-how gained as a result of offsets programme?

Yes ❒ No ❒

If yes, please indicate how you intend to do this:

……………………………………………………………………………………

……………………………………………………………………………………

4.14 Does your company have plans to extend its participation in offsets programme to include the following areas? (Please tick the appropriate column)

Area	**Yes**	**No**	**Comments**
Technology upgrading			
Product research			
Process research			
Market research			
Commercialisation of Research outputs			
Human Resource development and Training			
Others, please specify			

PART E: OFFSET PROGRAMME IMPACT:

5.01 Indicate the benefits of offsets on company performance:

More profit

Yes ❐ No ❐

If yes, provide figures for the 5 years

2000	2001	2002	2003	2004

5.02 More export:

Yes ❒ No ❒

If yes, provide export figures for the past 5 years:

2000	2001	2002	2003	2004

5.03 Technology innovation (Innovation here refers to new product, process, system or device).

Yes ❒ No ❒

If yes, provide examples of such innovation

5.04 Creation of new jobs:

Yes ❒ No ❒

If yes, what type of jobs and numbers over the past five years?

Type of work	**Numbers**				
	2000	**2001**	**2002**	**2003**	**2004**

5.05 Creation of skilled manpower in your organisation:

Yes ☐ No ☐

If yes, provide the number of workers and type of skills obtained:

Type of skills	Number of workers				

5.06 How were the skills generated /upgraded?

………………………………………………………………………………………

………………………………………………………………………………………

5.07 Enhancing existing product lines:

Yes ☐ No ☐

If yes, give examples of such activities

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

5.08 Strengthening of the local sub-contractor base:

Yes ❒ No ❒

If yes, please provide examples of such strengthening:

Type of work	Company involved

5.09 Ability to use technology gained for dual use application, mainly civil related projects.

Yes ❒ No ❒

If yes, provide examples of the projects:

Types of technology	Examples

5.10 Market penetration

Yes ❒ No ❒

If yes, provide examples of where and how it happened?

Local market	Foreign Market

PART F. OFFSETS IMPLEMENTATION

6.01 **Tick the appropriate box**

Implementation	**Yes**	**No**	**Sometimes**	**Comments**
Does your company participate during the offsets negotiation process				
Is your company informed of the final outcome after the offsets negotiation process				
Does your company have the adequate resources to undertake the offsets programme In terms of -Infrastructure, plant and machinery -Financial resources -Skilled workers -Commitment (marketing, R and D, training)				
Is your company's offsets programme completed on time				
Does your company's offsets project get completed within budget				
Was there adequate planning before the project begun				
Is there constant follow up and follow through from the OEM				
Does the MOD constantly monitor your company's offsets projects				

6.02 In the offsets agreement, is there any provision, which obligates the OEM to provide the following?

- Educational courses ❒
- Training services ❒
- Components and parts ❒
- Specialised technical services ❒
- Transfer of technical instructions and manuals ❒
- Transfer of hardware/machinery ❒
- Transfer of design ❒
- Consultancy services ❒
- Specialised research ❒

Local participation in R&D ❒

Local participation in design and construction ❒

Local participation in management ❒

Others ❒

6.03 Does the offsets agreement restrict the use of?

Local material resources ❒

Outside material resources ❒

Local machines and equipment ❒

Outside machines and equipment ❒

Local manpower ❒

Outside manpower ❒

Local market ❒

Regional market ❒

Outside market ❒

Other ❒

6.04 Does the offset agreement provide opportunities for future businesses?

If yes,

Explain in which field.

…………………………………………………………………………….. …

……………………………………………………………………………..

6.05 Are the obligations in the offset agreement strictly followed by the OEMs?

If not, why not.

…………………………………………………………………………….. …

……………………………………………………………………………..

PART G: FINAL SUGGESTION

Please suggest possible improvements to the effectiveness of offsets implementation in Malaysia

……………………………………………………………………….. ………………..

………………………………………………………………………….. ……………..

……………………………………………………………………….. ………………..

………………………………………………………………………….. ……………..

Thank you for your cooperation

Kindly return this questionnaire as soon as possible to:

Kogila Balakrishnan
Ministry of Defence, Malaysia
Bahagian Industri Pertahanan
Jalan Padang Tembak
Tingkat 8, Wisma Pertahanan
50634 Kuala Lumpur, Malaysia

Or via e-mail to **K.Balakrishnan@cranfield.ac.uk/ kogilab@yahoo.com**

ATTACHMENT 1: OFFSET PROGRAMME PROFILE (Please list out the items)

OEM	Name of equipment/ system/service	Year offset was obtained	Negotiated credit value offsets (USD)	Actual offset value utilised	Duration of offset Programme	Type of Offset Programme (choose from the following)	Activity involved (choose from the following)

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Appendix G: Defence Contractor’s Questionnaire

EXAMINING THE EFFECTIVENESS OF DEFENCE OFFSETS

Sections covered in the questionnaire

PART A: Company Details

PART B: Offsets Programme Obligations

PART C: Offsets Strategy

PART A: COMPANY DETAILS

1.01 Company Name :……………………………………………………...

1.02 Address: :……………………………………………………..

………………………………………………………………

1.03 Contact Person
/Designation :……………………………………………………..

1.04 Nature of Business :……………………………………………………..

1.05 Year Established :……………………………………………………..

1.06 Ownership :……………………………………………………..

PART B: Offsets Programme Obligations with Malaysia

Num	Name of Equipment /system/service (contract origin of offset requirement)	Year Commenced	List of projects (duration of programme, on-time project completion) (Attach brief synopsis separately)	Credit Value (USD)	Duration of programme

PART C: Offsets Strategy

Questions in section relate to technology transfer through Offsets

3.1 How does your company define 'core intellectual property' and what are the conditions under which your company may consider technology transfer?

3.2 To what extent does your government promote or restrict technology transfer? (eg: export control policy))

3.3 To what extent do indigenous Malaysian company capabilities promote or discourage technology transfer?

3.4 How does your company build the cost of offsets in its commercial packages?

3.5 What is considered an acceptable level of cost, as a percentage of contract value, when planning for executing an offset programme? How does your firm defray?

If yes, please provide a percentage?

…………………………………………………………………………………..

3.6.1 What are the strengths of the Malaysian companies that you have worked with on offsets programme?

3.7 Do you intend to establish long term supplier relationship with Malaysian companies through offsets?

3.8 What are the weaknesses and challenges you have faced by working with the Malaysian companies?

3.9 Do you have offsets obligation with ASEAN or other countries in the region?

If yes, which countries?. How do their offsets programmes differ from Malaysia

3.10 Are Malaysian companies competitive in comparison to their ASEAN and regional neighbours?

3.11 What should Malaysian companies do to be the subject of a successful long-term benefit of offsets programme?

3.12 What are your observations about Malaysia's offsets policy and processes?

3.13 Explain the nature of any problems faced by your company during the offsets negotiation phase?

3.14 How do you view Malaysia's offsets policy and implementation process?

3.15 What aspects of your offsets obligations have been more challenging than the others?

3.16 List the advantages and disadvantages of requiring offsets as a part of major contract

3.17 Do you see any other formal alternative to offsets when selling defence equipment, systems or services?

3.18 Would you agree that offsets are the way forward for developing countries to:

3.18.1 built their indigenous defence industry capability?

3.18.2 as an economic development tool into other sectors?

a. Do you intend to incorporate buy-back provisions into offsets programme?

b. Would you explain your best (most successful) offset project, and would you describe generally the worst.

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Appendix H: Details of Defence Suppliers Interviewed During Fieldwork Research

Num	Organisation	Country	Year established	Nature of business	Ownership	Offsets obligation
1	ARMARIS	France	2002	Naval systems	DCN and Thales	600 million USD
2	Boeing Company	US	1930s	Military systems and commercial aircrafts	Public-owned	USD 271Million
3	BAE Systems	UK	1850	Aerospace and defence		
4	MBDA(UK)	UK, France, Italy	Over 50 years	Defence(guided weapons sector)	BAEs-37.5% EADS- 25% Finmeccanica-25%	
5	BAE Land Systems(Vickers)		1989	Military bridging equipment	BAEs	USD 30 million
6	Bumar Labedi	Poland	1950	automotive	State owned	
7	Rosoboronexport	Russia	1980	Weapon system sales	State owned	USD 900,693,415.00 million

Num	Organisation	Country	Year established	Nature of business	Ownership	Offsets obligation
8	Whitehead Alenia	Italy	1875	Under sea defence systems	Finmeccanica	
9	Navantia	Spain	1947	Military naval construction	Navantia S.l	129 million Euros
10	FNSS Defence System	Turkey	1988	Defence equipment, tracked and wheeled armoured combat vehicles	51% UDLP of US 49% Nurol Holding of Turkey	
11	GKN Westland	UK		aerospace		
12	Environment Tetronics Corporation	US	1969	Pilot and aircrew training systems	AMEX under symbol ETC	
13	DENEL	South Africa				NA

Appendix I: List of Malaysian Offset-Related Agencies Interviewed

Num	Organisation
1	Ministry of Defence • Procurement Division • Defence Industry Division • STRIDE • Policy Division
2	Ministry of Finance • Contract Division
3	Economic Planning Unit, Prime Ministers Department
4	Ministry of International Trade and Industry • Bilateral Trade Division
5	National Aerospace Council
6	Malaysian Industry Group for High Technology(MIGHT)
7	Ministry of Science and Technology (MOSTE)
8	Malaysian Defence Industry Council
9	Technology Park
10	University Technology Malaysia
11	University Science, Malaysia
12	Multimedia Development Corporation
13	SIRIM

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Appendix J: List Foreign Offset Offices Interviewed

Num	Organization
1	Defence Export Services Organisation (DESO), UK
2	Department of Trade and Industry, UK
3	ARMSCOR, South Africa
4	American Countertrade Association (ACA)
5	Defence Manufacturers Association(DMA),UK
6	DGA, France
7	ISDEFE, Spain
8	Department of Commerce's Defence Trade (BXA) ,US
9	Defence Material Organisation, Department of Defence, Australia
10	Asia Pacific Countertrade Organisation (APCA)
11	Defence Division, Confederation of Indian Industry
12	Swedish Defence Material Administration, Sweden
13	United Arab Emirates Offsets Group, UAE
14	Deutsches Kompensations Forum e.V (DKF)
15	Ministry of National Defence, Republic of Turkey

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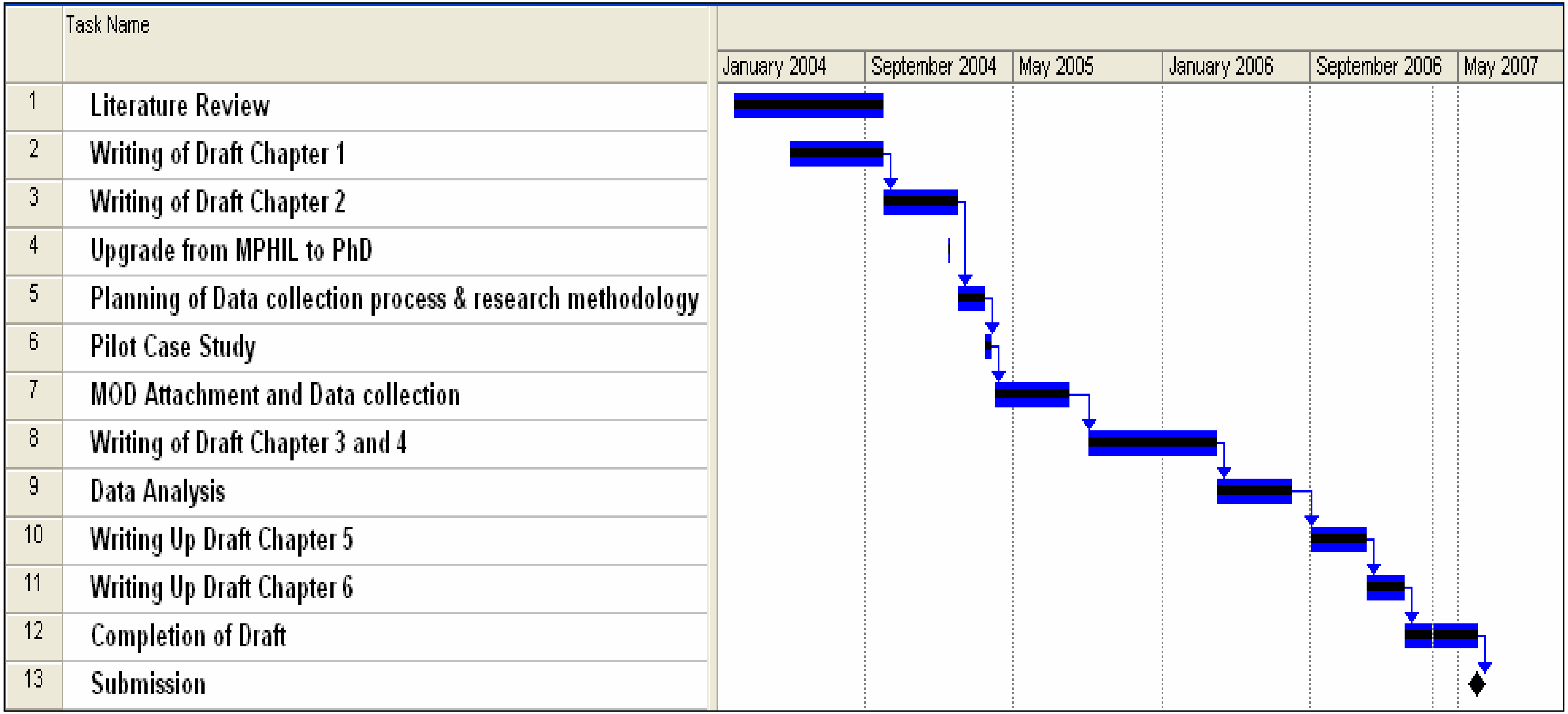
Appendix K: SUMMARY OF RESEARCH PLAN

Num	Stage	Timeline	Target Group	Task	Comments
1	Literature Review	Jan 2004-Jan 2005		Gather primary and secondary sources to identify the gap	Literature review will be a continuous process
2	Questionnaire and semi-structured interview preparation	Feb-April 2005	• Identified Malaysian firm • MOD • DESO • BAE Systems MBDA,UK	• prepare questionnaire • prepare cover letter • send out the draft to the relevant organisations • receive input and make necessary amendments	Letter will be written to MOD, Malaysia to seek official permission for attachment
3	Pilot Study	April- May 2005	• Beneficiaries of MBDA programme • CTRM • SME Aerospace • MMC Engineering • Malaysian Armed	• sent out questionnaire by post and e-mail and provide 2 weeks time to return questionnaire • identify the problems and rectify the questionnaire	This questionnaire will be sent out from UK and therefore follow-up telephone calls will have to be made to ensure the progress

Num	Stage	Timeline	Target Group	Task	Comments
			Forces		
4	Sending out survey questionnaire	May –June 2005	• Send out questionnaire to all beneficiaries	• counter check beneficiary list with MOD • indicate timeline • follow up call to fix - appointment and collect the questionnaire personally	Questionnaire will be sent out from Malaysia by using the Defence Industry Div, MOD office facilities
5	Semi Structured Interviews	June 2005	• Identified government officials, OEMs and offsets related organisations	• fix appointments to interview government officials, OEMs and other offsets organisation that has been identified	

Appendix L: Study Implementation Schedule



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Appendix M: MALAYSIAN ARMED FORCES INVENTORY

Source: Military Balance 2005.2006, The International Institute of Strategic Studies

MALAYSIAN ARMY

TK.LT.TK. 26 Scorpion 90

RECCE 418

AML 140: 140 AML-60/AML-90

FERRET 92 960mod)

SIBMAS 186

APC 1020

APC (T) 347; 211 Adnan (incl variants); 25 FV 4333 Stormer;

111 KIFV (incl variants)

APC (W) 673:452 Condor 9150 upgraded); 37 m-3 Panhard;

184 LAV -150 Commondo/V-100 Commando

ARTY 414

TOWED 164

105mm 130:130 Model 56 pack Howitzer

155mm 34:12 FH-70; 22 G-5

MRL 18: 18 ASTROS II (equipped with 127mm SS-30)

MOR 232: 232 81mm

AT

MSL 60:18 AT-7 Saxhorn; 24 Eryx; 18 HJ-8

RCL 260

106mm 24:24 M-40

84mm 236: 236 carl Gustov

RL.73mm 584: 584 RPG-7 Knout

AMPHIBIOUS.CRAFT.LCA 165

165 Damen assault craft 540 (capacity 10 troops)

HELICOPTERS.UTL.SA-316 9: 9SA -316B Aloutte III

AD

SAM. MANPAD.48+: some Anza; some SA-18 Grouse (Igla); 48 Starburst

GUNS 60

35mm: 24 GDF-005 towed

40mm: 36 L40/70 towed

MALAYSIAN NAVY (15,000)

PRINCIPAL SURFACE COMBATANTS 10

FRIGATES 4

FFG 2:

2 lekiu (capacity 1 super lynx utl hel) each with 2 B515 ILAS -3 triple 324 mm each with 1 sting ray LWT, 2 quad (8eff.) each with 1MM -40 Exocet tactical SSM, 1 Sea Wolf VLS with 16 sea wolf SAM

FF 2

1 hang Tuah trg with Limbo non-operational, 1 57mm gun, 1 hel landing platform (for Wasp or super Lynx)

1 rahmat with 3 Limbo, 1 114 gun, 1 hel landing Platform

CORVETTES 6

FSG 4

4 laksamana each with 2 B515 ILAS-3 triple 324mm

Each with A244LWT, 1 quat (4 eff.) with 12 Aspide
SAM, 3 twin (6 eff) each with 1MK 2 Otomat SSM,
176mm gun

FS 2
2 kasturi each with 2 twin (4eff).each with 1 MM-
38 Exocet tactical SSM, 1 Mle 54 Cruesot-Loire 375mm
Bofors (6 eff.) 1 100mm gun, 1 hel landing platform
(for 1 westland wasp HAS Mk 1)

PA|TROL AND COASTAL COMBATANTS
PCC 18: 14 kris; 4 sabah
PC1 1 **:** 1 Kedah
PFC 6 : 6 Jerong
PFM 8:
4 handalan each with 2 twin (4 eff.) each with MM-38
Exocet tactical SSM, 157 mm gun
4 Perdana each with 2 single each with 1MM -38 Exocet
tactical SSm, 1 57mm gun

PCO 2
2 Nustytari each with 1 100mm gun, 1 hel landing platform

MINE WARFARE. MINE COUNTERMEASURES.
MCO 4: 4 Mahamiru
AMPHIBIOUS
LS.LST 1: 1 Sri Inderapura (capacity 10 tanks;400 troops)
AGHS (Svy) AGOS 2
AMPHIBIOUS
CRAFT 115: 115 LCM/LCU
LOGISTICS AND SUPPORT 3: 1 diving tender/spt;2 Spt

MALAYSIAN AIR FORCE (15 000)

Flying hours- 60 hours/ year

FORCES BY ROLE

Ftr	2 Sqn with 15 MiG-29n (MiG-29) *fulcrum*; 2 MIG-29U *Fulcrum*
FGA	1 sqn with 8 f/A-18D Hornet; 2 sqn with 8 Hawk MK108; 17 Hawk MK208
FGA/ Recce	1sqn with 13 F-5E Tiger II; 2 RF-5E Tigereye
MR	1sqn with 4 Beech 2000T Maritime Patrol
SF	1 (Air Force Commando) unit (air field defence)
Tpt	2 sqn with 4 KC-130H *Hercules* (tkr); 4C-130H *Hercules*; 8C -130H-30 *Hercules* ; 9 Cessna 402B (2 modified for aerial survey); 1 (VIP) sqn with 1 b 737-700 BBJ; 1 BD700 *Global Express;* 1 F-28 *Fellowship*; 1 *Falcon* 900; 2 S- 61N; 2 S-70A *Black Hawk;* 1A-109; 1sqn with 6 CN-235
Trg	some sqn with 8MB-339A;20 MD3-160; 45Pc-7 MK II *Turbo Trainer*; 13 SA-316 *Aloutte III*
Hel	4(tpt/SAR) sqn with 31 S-61A-4 *Nuri*; 2S-61N;2 2-70A *Black Hawk*
SAM	1 sqn with *Starburst*

EQUIPMENT BY TYPE

AIRCRAFT 63 combat capable

FTR 28

F-5 13: 13 F-%E Tiger II/F-5F Tiger II

MIG-29N (MIG-29) ***Fulcrum*** 15

FGA 16

F/A-18 8:8 F/A-18D *Hornet*

Hawk **MK108** 8

RECCE 2: 2 RF-5E Tigereye

MP 4: 4 Beech 200T Maritime Patrol

TKR.KC-130 4: 4 KC-130H Hercules (tkr)

TPT 31

B-737 1:1 B -737-700 BBJ

BD700 ***Global Express*** **1**

C-130 12: 4C -130H Hercules; 8 C-130H-30 Hercules

CN-235 6

CESSNA 402 9:9 cesssna 402B (2 modified for aerial survey)

F-28 ***Fellowship*** **1**

Falcon **900** 1

TRG 92

Hawk **MK208** 17*

MB-339 8: 8MB-339AB

MD3-160 20

MiG-29U ***Fulcrum*** 2*

PC-7 45:45 PC-7 MK II Turbo Trainer

HELICOPTERS

ASW.**S-61.S-61A** 31:31 S -61 A-4 Nuri

SPT 8: 4S -61N; 4 S-70A Black Hawk

UTL 14: 1A-109; 13 SA-316 Aloutte III

UAV.RECCE.TAC 3: 3 eagle 150

AD.SAM. MANPAD: some starburst

MSL.TACTICAL

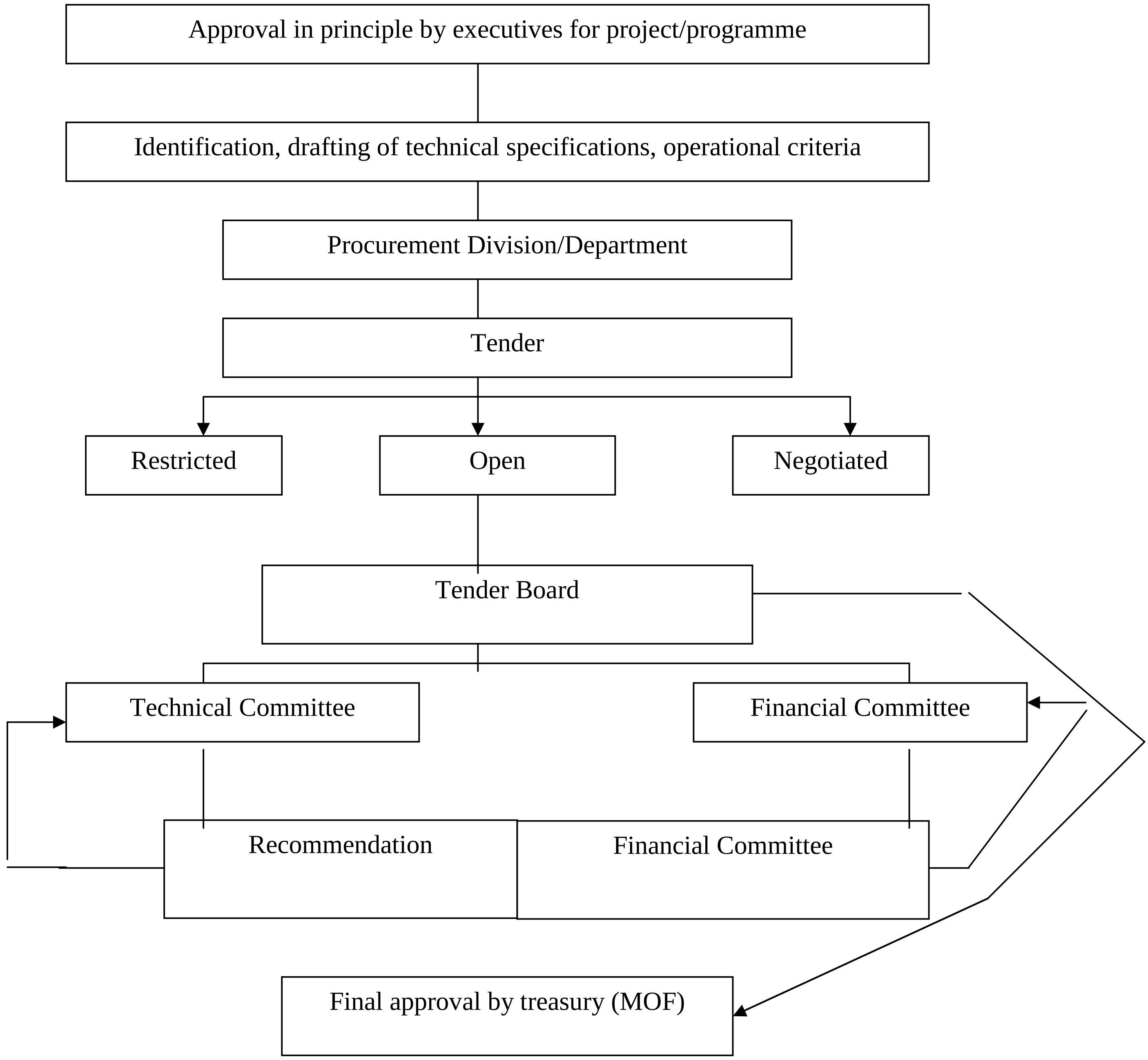
ASM: some AGM-65 Maverick; AGM-84D harpoon

AAM : some AA-10 Alamo; AA-11 Archer; some AIM-7

Sparrow some AIM-9 Sidewinder

Source: *Military Balance*, The International Institute for Strategic Studies, Routledge, London, 2007

Appendix N : Stages In Arms Procurement Process In Malaysia



Source: Mak, J.N, 'Security Perceptions, Transparency and Confidence-Building: An Analysis of the Malaysian Arms Acquisitions Processes, *SIPRI Arms Procurement Decision Making Project*, Working paper no.82, 1997.

There are a total of seven stages in the overall procurement process

Stage 1:

The General Staff Requirements (GSR) at Armed Forces level for single services are generally for the purchase of equipment off-the-shelf. For army, GSRs are examined in the **Army Operational Equipment Committee,** consisting of Deputy Chief of the Army and heads of the relevant departments –logistics, equipment, mechanical and other specialisations. The GSRs are examined in line with army doctrine, operational factors and training requirements and then passed to the procurement division of the MOD to be processed by a technical evaluation committee. For the Air force, procedure involves the **Technical Specification Committee** which passes the Air Staff Requirements to the Air Specification Committee and then to the MOD procurement division to be processed by the technical evaluation committee. For the Navy, GSRs are evaluated by the Chief of Navy Committee, which passes them on to the procurement division, MOD for the same process

Stage 2

For capital items made to order, a specification committee for each service drawn from different equipment departments of the services according to requirements and one for the three services jointly will test the viability and local content. Deputy heads of the services coordinate the recommendations and pass them on to the procurement Division of the Ministry of Defence.

Stage 3

The Procurement Division is headed by an under secretary who reports to the Secretary General. A technical committee is formed to evaluate the Members of the Specification committee are drawn from executive offices of MOD and Diplomatic and Administrative services. The division will than decide on method of procurement and type of tender. MOD handles procurement below 5 million (US 1.3 million); proposals for items costing more than that must be approved by Treasury. Then proposals are evaluated by the Technical Committee of the Procurement Division

Stage 4

Technical evaluation committee carries out technical evaluation and field test for the suitability of the equipment in terms of specifications and user requirements. It also examines life-cycle costs, local content, infrastructure and other logistical requirements. The technical evaluation team comprises end-users and technical experts from relevant MOD departments, such as the Defence Science and Technology Centre (STRIDE), Defence Industry Division and IT Division. Membership to this committee is determined by MOD and rarely, does involve experts from outside the government. Debate over government purchases is usually confined to the technical committee established for a particular tender, whose composition varies according to the type of equipment purchased.

Stage 5

The procurement division will than decide on method of procurement and type of tender;

i. **open tender:** bidders required to meet basic criteria
ii. **restricted tender** :designed to save time when potential suppliers are few because the equipment involved is highly specialised
iii. **direct/ negotiated tender:** supplier identified as the only one offering the equipment that meets the specific requirements of a user agency- spare arts for vehicles that are not available from any other sources. Negotiations carried out to establish price, delivery dates, support and etc. can also apply in a government to government purchase. Negotiations for tenders below RM 5 million will be chaired by Secretary General and negotiations for tenders above that will be chaired by Treasury. The end users identify and write out technical specifications and operational criteria which are then incorporated into the tender document.

Stage 6

For tender evaluation to take place, the procurement division forms a tender board comprising technical committee and financial committee. The technical committee comprises technical experts from services, STRIDE, IT and than submits a tender brief to the tender board. Financial evaluation committee evaluates the financial merits of the proposals such as industrial offsets, financial packages including modes of payment schedule, and other cost-related criteria. The tender board is chaired by Secretary General of MOD and comprises the Deputy Secretary General for Development, representatives from the Armed Forces HQ, the services and the treasury.

Stage 7

The tender board will consider the tender brief and either approves or rejects the recommendations, or calls for re-tender. Treasury has the right to accept or reject any or all proposals against the recommendations of the tender board and tender sub-committees (technical and financial evaluation). For tenders called by treasury, MOD will forward technical evaluation report directly to the treasury. If treasury handles procurement of certain high-value equipment, a special committee will be appointed to look into the commercial proposal before the request for proposals (RFP) is made. Committee looks into delivery, costs and terms of payment, warranty and aspects of offsets and countertrade, TOT and local content.

Stage 8

The final approval for the procurement will than be made by the Ministry of Finance(MOF)

Appendix O: MDIC Members

Num	Company	Sector	Year Established	Capabilities
1	Airod	Aerospace	1976 (1984-private limited company)	Aircraft Maintenance, Modification and Upgrades, -Engines & Component Repair and Overhaul, -Aero Components Repair and Overhaul, -Avionics Components Repair and Calibration. -Avionics Components Repair and Calibration. -Manufacturing of Portable Minefield Lighting System
2	Composite Technology Research Malaysia(CTRM)	Aerospace	1991	Eagle 150B Two seater, all composite, GA aircraft with a cruise speed of 125 knots, fitted with sleek features that are perfect for

Num	Company	Sector	Year Established	Capabilities
				leisure and sports flying. -Lancair Columbia 300 Four seater, all-composite, GA aircraft, fastest and sleekest aircraft in its category. -Eagle ARV System Provides a flexible airborne surveillance and reconnaissance system with dual capability for manned and unmanned operations, day and night capability, range 200 km and endurance 10 hours. -AEROSPACE SERVICES • Research & development • Design & Engineering services • Manufacturing • Assembly • Testing • Certification
3	SME Aerospace	Aerospace		Aerospace ground support equipment; • Air-borne ordnance and parts (including training • rockets & bombs); • Machining and assembly; • Hydraulic actuators; • Sheet metal fabrication services; • Welding services.

Num	Company	Sector	Year Established	Capabilities
4	Zetro Services Sdn Bhd	Aerospace	1981	Design, fabrication, overhaul, repair, calibration, upgrading and maintenance of avionics components systems for all aircrafts in RMAF. Design, fabrication, overhaul, repair, calibration and maintenance of all ground electronic equipment/systems in the RMAF including total maintenance of Air Traffic Control Equipment and Systems. Repair and Overhaul of Army Artillery Electronic Equipment & Systems and Communication Equipment & Systems for the Royal Malaysian Police and the Oil & Gas Industry. Design, Installation, Integration and Commissioning of radar systems for air defence, air traffic control and maritime surveillance
5	ATSC	Aerospace		
6	SME Aviation	Aerospace		
7	UPECA Engineering	Aerospace	1990	
8	Hong-Leong-Lurssen Shipyard (1992)	Maritime		Building , repairing and overhauling of naval ships and patrol craft.

Num	Company	Sector	Year Established	Capabilities
	Sdn Bhd			
9	Malaysia Shipyard & Engineering Sdn Bhd	Maritime	1953	Ship repair, shipbuilding and heavy engineering -works for onshore and offshore projects. Other support services are: - 1) Processed copper blasting grit 2) Oil sludge treatment plant 3) Tugs and towage services
	ME&O Fleet Support Services Sdn Bhd	Maritime		Inventory control and management system/Bar coding; Lighting protection system ship preservation system.
	PSC - Naval Dockyard Sdn Bhd	Maritime		Dockyard services and -engineering services - mechanical / electrical -engineering, hull and docking services, electronic and weapon system. -Specializes in complete overhaul, upgrading and maintenance of medium calibre canons, naval -gun, artillery equipment and its associated systems.

Num	Company	Sector	Year Established	Capabilities
				-Universal tests electronic defence industry especially in the field of combat, command and control system.
	Sigma Xi Engineering Sdn Bhd	Maritime		Maintenance of naval communication equipment; integration of communication and weapon systems.
	D'Aquarian			
	Nautica Nova	Maritime		
	SME Ordnance	Weapons	1969	Manufacturing of: Small Arms Ammunition:- - 5.56 mm Ball M193 (Loose/Link) - 5.56 mm Tracer M196 - 5.56 mm Ball M855/SS109 - 5.56 mm Blanks (Long Nose) - 5.56 mm Blanks M200 - 7.62 mm Ball (All Natures) - 7.62 mm - Link Belt 4 (BIT) - 9 mm. Ball (Luger / Parabellum) - .38 Special (Lead Round Nose) • Medium Calibre Ammunition

Num	Company	Sector	Year Established	Capabilities
				- 12.7 mm APIH / IT, - 20 mm Oerlikon HEI-T - 30 mm ADEN TP - 25 mm all types - 35 mm all types ●Shotgun Cartidges - 12 Gauge Shotgun Cartridge (various type) ●Pyrotechnics & Grenades - Coloured Smoke Grenades All Colour - Mini Flares (set of six) - Wire Tripflares - Day & Night Signal Distress - Ground Illuminating Flares - Aviation Smoke Generator - Signal Cartridges 1"/26.5 m - Signal Cartridges 1 1/2"/38 mm - Cart. C.S. Anti Riot 38 mm - Grenade Hand C.S Anti Riot - Grenade Hand High Explosives - Detonating Cord - Electric Detonator - Non Electric Detonator - Safety Fuze' (per meter) - Handflare Red Para - Thunderflash ●Large Calibre Ammunition

Num	Company	Sector	Year Established	Capabilities
				- Mortar Bombs 81 & 60 mm - Rounds 40 mm L70 HEI-T - Rounds 105 mm HE MI - Mortar Bombs 81 mm HE 71 b - Rounds 40 L70 TP-T - Rounds 57 mm L70 TP - Cartidges 105 mm Blank PH - Scare Charge Demolition TNT 1 lb - Charge Demolition 10 lbs and 25 lbs - Cast Booster 250g TK 1 and 500g TK2 - Round 90 mm HE-T - Round 90 mm HESH-T - Round 90 mm HEAT-T - Round 90 mm HEAT-TP-T - 84 mm HEAT 551 - Rd 76 mm TP-T - Rd 155 mm HE M107 • Weapon - Steyr AUG A1 Rifle, Mess Tin Complete, Water Bottle Complete • Engineering Plastic Division (EPD) - Defence Related - Steyr AUG Rifle Butt and Other Components - PPC Canister for ammunition 105 mm, 40mm L70, 81 mm Mortar, Toilet seat • Metal Boxes

Num	Company	Sector	Year Established	Capabilities
				- M2A1, BG - 69/M61, H84, 9 mm, M548, A125
	DRB - Hicom Defence Technologies Sdn Bhd	Automotive	1996	-A flexible manufacturing plant for the assembly of armoured vehicles (wheeled and tracked) of up to 50-ton Main Battle Tank as well as for system integration of specialist vehicles. • A workshop for the repair (including base overhaul), maintenance and refurbishment of soft-skin and armoured vehicles. • A warehouse with the requisite facilities for the stocking and distribution of spare parts nationwide. • A computerized materials resources planning system (MRP) for production and control planning and inventory management. • A NATO standard vehicle test track in close proximately to the plant.

Num	Company	Sector	Year Established	Capabilities
	MMC Defence Sdn Bhd	Automotive	1986	Base maintenance, refurbishment, upgrade and Research & Development works for armoured vehicle variants, both track as well as wheeled vehicles. -Expertise in turret and gun system (20mm and 90mm)
	Pesaka Astana(M) Sdn Bhd	Automotive	1992	Manufacturer of Customized and specialized vehicle • Military truck, Fire & Rescue Vehicle, Medium and Heavy Recovery Vehicle, Port Terminal Tractors • Manufacturing truck and total after sales services
	Scomi	Automotive		-Manufacturing and fabricating of quality road transport hardware. Providing related engineering services and distribution of transportation related equipment. -Articulated Vehicles <u>Tankers (Pressurized/Non Pressurized)</u> • Aluminum tankers (petroleum products) • Mild steer tanker (palm oil, latex, diesel etc) • Stainless steel tank • Liquefied petroleum gas (LPG) • Chemicals

Num	Company	Sector	Year Established	Capabilities
				• Flour/feed • Cement <u>Trailer</u> • Cargo semi trailers • Car carriers • Container trailers • Low loaders • Telescopic pole trailers • Box van trailers • Port trailers • Tipping trailers • Curtain side trailers <u>Truck Mounted Vehicles</u> • Water tankers • Refuse compactors • Roll on roll off mechanism (arm roll) • Sewer cleaner • Tipper • Aerial platform • Refrigeration body • Vacuum tankers <u>Airport Ground Handling Equipment</u> • Aircraft refuellers • Hydrant dispensers • Passenger steps • Toilet/water servicing trucks

Num	Company	Sector	Year Established	Capabilities
				• Belt loaders <u>Utility Vehicles</u> • Aerial hydraulic platforms • Towing and recovery vehicles • Crane augers <u>Others</u> • Beach cleaners • Tail lift • Hydraulic cranes • Road sweepers • Wood chippers • Incinerator/cremator • Compressor • Port tractors • Military support vehicles • Ambulance • Mobile dental clinics • Mobile clinic • Hearse body <u>Related Engineering Services</u> • Consultation, designing, problem solving, parts repairs and training in specialized transportation engineering field.

Num	Company	Sector	Year Established	Capabilities
	Land Rover Malaysia	Automotive	1991	
	Caidmark	ICT	1986	-For military- Focus in Condition Based Maintenance (CBM). ECMS, which is a general-purpose database system, designed to track the location, configuration, life usage status, and condition and maintenance history of serialized aircraft components. ECMS covers both engine and structural components and is applicable to naval and • Fort OGP sectors – Caidmark's emphasis will be in providing solutions in reliability engineering. 1. Plant Information Management System, CBM, Reliability Centred Maintenance (RCM) and expert system based framework for the side wide deployment of reliability and operation management application. 2. Intelligent Building Management System

Num	Company	Sector	Year Established	Capabilities
	Comintel	ICT		System engineering design and integration for telecommunication equipment and weapon systems
	Comlenia	ICT		Integrated logistics support, electronic systems, repairing and testing including combat systems upgrading activities. • Capable of 3rd level repair and testing for all ranges of electronic cards from analog, digital and IF/RF using latest state of the art, fully computerized Automatic Test Equipment.
	Ikramatik Systems Sdn Bhd			Simulation technology provider. Specialise in cost-effective Flight Simulator including - Fixed-wing type and Helicopters. Develop Computer Assisted Training Systems for aircrew and ground support person
	Malaysian Optronics Systems Sdn Bhd	ICT		Assembling of laser range finder, night vision binoculars and optical sighting devices • Upgrading of laser range finder, night vision

Num	Company	Sector	Year Established	Capabilities
				device to suit user requirement.
	M.A.R. Communication Support & Services Sdn Bhd	ICT		Secure land and seaborne communications systems
	Marconi Malaysia Sdn Bhd	ICT		Manufacture and maintenance of telecommunication equipment (SDH, DLC, ATM and Manages Leased Line Systems).
	Sapura Technologies Sdn Bhd	ICT		Design, manufacture, integrate, supply and maintain communications products and systems • Design, develop, integrate and maintain flight, maritime, land-based and radar simulators – provides computer-based training that utilizes web-based technologies for the Armed Forces • Marketing, supply, operate and maintain various radar and air traffic management systems • Perform various maritime business activities especially in electronic and training • Development of Electronis Warfare

Num	Company	Sector	Year Established	Capabilities
				system pertaining to EW Support System • Full range of services to support Malaysia Armed Forces non-core activities such as marketing and supply of firearms Training Systems and development & integration of computerized logistics management system
	SCS Consultancy Services Sdn Bhd		1991	Specializing in consultancy in ICT, development and integration of Command, control, Communication and Intelligence (C31) system as well as Information Warfare System with particular emphasis on Electronic Warfare system. Scada Systems, Industrial and Process Automation Solutions, Buildings Security Solutions and Fiber Glass Composite products manufacturing.
	Satang Jaya	ICT		
	Teliti Computers	ICT		

Num	Company	Sector	Year Established	Capabilities
	Tronomatics	ICT	1994	
	XYBase	ICT		
	Kinta Swichgear Sdn Bhd	ICT	1994	
	Teknik Padu Sdn Bhd			Total solution for Integrated Logistic System Packages: - • Planned Maintenance System • Inventory System • Training Development on Naval and marine systems and equipment • Configuration Management System • Electronic Documentation

Num	Company	Sector	Year Established	Capabilities
				• Computer Support System Project Management • IT network and system • Naval and engineering installation and commissioning work • Shipbuilding • Ship repairing Training • Training plan • Training development Programme • Conduct of Training • Training validation Products • Decoy launchers • Ships control and monitoring system • Integrated Communication System • Software for Material Management shipbuilding and ship repairing • Maintenance management software • Ships design software
	Amalgamated Metal Builders (M) Sdn Bhd	Common Users		Providing engineering services and support : • Steel fabrications • Installation and commissioning of plant • Civil & structural works

Num	Company	Sector	Year Established	Capabilities
				• Maintenance services Products Vessels, Shell & Tube Heat Exchangers, Reactors, Towers/Columns, Casting Ladles, Loading Arms, Flare Stack, Piping Works and other steel fabricated products.
	Dewina Food Industries Sdn Bhd]	Common Users		Manufacturer of retort pouch rations and tin food; -Processing of combat rations.
	Glowtrade (M) Sdn. Bhd	Common Users		Manufacturer of Parachute, parachute systems, components and accessories, canopy, tents, military webbing equipment/load carrying equipment, ammunition pouches, rucksacks, flying suit and universal kit bag.
	Kulitkraf Sdn Bhd	Common Users		Manufacture of combat boots/ Drill Boots/ Spike Proof/ Flying Boots & Safety Shoes (SIRIM MS 967:1985 & EN 345/ MS ISO 9002 REG. NO. AR 1819 & A member of SATRA – Footwear Technology Centre.
	Pakaian Saling Erti	Common Users		

Num	Company	Sector	Year Established	Capabilities
	Puspamara	Common Users		
	Nadicorp holdings Sdn Bhd	Common users		
	Semenanjung Selatan	Common Users		

Source: Ministry of Defence, Malaysia, *Members of the Malaysian Defence Industry Council*, [Online], (Accessed: 29 September 2005), Available at: http://www.mdic.gov.my.

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Appendix P: Ministry of Finance, Malaysia's 1999 Offsets Document

Offsets Programme in Government Procurement

1. Introduction

1.1 The Government Procurement Management Division, Ministry of Finance is responsible in the management of procurement of the Federal Government

1.2 The primary objective of government procurement management is to get value for money. However, it also aimed at achieving the following objectives:

1. encourage greater participation of Bumiputera in trade and industries;
2. maximise the utilisation of local resources (local content)
3. promote the development of local industry
4. transfer of technology to local industry
5. minimize the outflow of foreign exchange through greater utilisation of transportation and insurance services provided by local companies
6. creating opportunities of local companies in the services sector; and
7. generating concessions through reciprocal trading arrangements. Offsets Programme and industrial cooperation to enhance further Malaysia's export capabilities.

2. BACKGROUND OF OFFSETS PROGRAMME

2.1 Definition

- Offset is one form of countertrade whereby it is a buyer's attempt to control the site of production or flow of technology where the buyer compels the seller to manufacture certain components in the buyer's country and agrees to transfer the latest production technology and to buy the goods produced either to be exported to the country of origin or to some third countries
- Under OP the buyer could request the supplier to make purchases of unrelated goods from the buyer's country to be marketed in the seller's country or in some third countries
- OP is commonly seen in aircraft defence equipment procurement. However, its application has now spread to procurement of other items.

2.2 Types of OP

There are two types of OP, namely, Direct Offsets and Indirect Offsets

2.2.1 Direct OP

Direct OP refers to activities which are directly related to the equipment purchased. The activities could be in the following forms:

- Purchase of parts and components with local content for use in the Equipment.
- Co-production undertaking by the COMPANIES and/or the Eligible parties to co-produce parts and components of the Equipment.
- Investment by the COMPANIES and/or the Eligible Parties in Malaysia to manufacture parts and components of the Equipment purchased.

- Transfer of technology to Malaysian firms, agencies or institutions of specialised knowledge relating to processes of certain parts and components, of the Equipment. This includes patents, licenses, software, technical access to current expertise and data.
- Enhancement of Malaysian technical services and maintenance capabilities
- Technical assistance or training associated with activities which contribute directly to the equipment and / or the parts and components for such Equipment
- Buy-backs of the parts and components of the Equipment produced or assembled in Malaysia
- Assistance in marketing of the parts and components for the equipment overseas; and
- Any other activities mutually agreed upon by the PARTIES.

2.2.2 Indirect OP

'Indirect OP' refers to activities which are unrelated to the equipment purchased. The activities could be in the following forms:

- Co-product and/or direct investment by the COMPANIES and the Eligible Parties in Malaysia to manufacture unrelated products of technology currently not available in Malaysia
- Transfer of technology to Malaysian firms, agencies or institutions of specialised knowledge relating to processes of products unrelated to the Equipment purchased under the CONTRACT which are applicable to both the defence and/or other industries. This include patents, licenses, software, technical data, process instruction and the continuing access to current expertise and data
- Technical assistance or technical training with the manufacture of unrelated products and/or parts and components
- Buy-back of the resultant products
- Assistance in the marketing of the resultant products overseas
- Research and development programmes which have the potential to contribute to Malaysian industrial development by generating new activities or enhancing existing activities associated with exports
- Exports of unrelated Malaysian products under a special arrangement
- Assistance to Malaysian institutions of higher learning in certain educational fields; and
- Any other activities mutually agreed upon by the PARTIES.

3. OP IN THE MALAYSIAN GOVERNMENT PROCUREMENT

3.1 OP is only imposed on government procurement from foreign companies with contract value more than RM 10 million

3.2 The Government of Malaysia introduced OP mainly to achieve the following objectives:

(a). to promote technology transfer
(b). to increase the utilisation of local parts/contents and local labour; and
(c). to help Malaysian companies penetrate foreign market through counter purchase

3.3 OP proposal is normally studied thoroughly by a technical committee before it is submitted to steering committee for approval

3.4 The functions of the Steering Committee are as follows:

(a). evaluate and approve or reject proposal for implementation
(b). provide alternative plans if proposal is rejected
(c). evaluate the financial status of the project
(d). identify beneficiaries
(e). extend professional/expert assistance

(f). monitor the implementation of OP

3.5 The function of the Technical Committee is to evaluate OP proposals, identify relevant beneficiaries, negotiate with the technology provider on credit value and other terms and conditions and finally submit its recommendations to the Steering for approval. During the implementation of the OP activities, the Technical Committee is responsible in monitoring the progress of the activities and submits report to the Steering Committee.

3.6 The OP beneficiaries are as follows:

(a). Government agencies-e.g. MINDEF, Department of Civil Aviation, UTM etc
(b). Government companies-e.g: Petronas
(c). Prime companies-e.g: Airod, SAPURA, CTRM, Zetro, Ancom etc

4. COUNTERPURCHASE IN GOVERNMENT PROCUREMENT

MOF has also undertaken counterpurchase (CP) arrangements in executing Government procurement. It is merely carried out to help Malaysian companies penetrate foreign market.

In CP arrangements the supplier purchases Malaysian goods and commodities directly from Malaysian companies in return for the sales of the supplier's goods.

Terms and conditions of the CP are being negotiated in terms of value, types of goods and commodities. The Government then provides the list of countertrade companies /. trading house and the supplier would then select and gets the necessary approval to implement the CP.

5. CONCLUSION

Observed that OP has so far benefited Government as well as private companies. Therefore, the Government will continue the application of OP in the future procurement.

Government Procurement Management Division,
Ministry of Finance, Malaysia

Date: 23 October 1999

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Paper Presentation at the Conference on Defence Technology 2005 in Marriott Hotel, Putrajaya, Malaysia, 30 November–1 December.

Defence Offsets as a tool for Technological and Industrial Development: The Case of Malaysia

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ABSTRACT:

Defence offsets are of paramount importance in the arms trade of the 21st Century. As a condition of purchase, the seller agrees to compensate the buyer either through an economic compensation package or reciprocal trade practice. Of late, there has been increasing awareness on the subject of offsets due to the huge sums of cash transactions involved in these deals. Given the fact that offsets are normally tied to arms sales, with secrecy and non-transparent data, there has been a poverty of research in this field. Most research conducted has focused on the effectiveness of offsets in the developed countries, particularly the United States and the United Kingdom. For example, the US Department of Commerce produces an Annual Report examining US offset activities around the world. Similarly, UK Defence Export Services Organisation or DESO keeps track of its offsets (Industrial participation) programmes and provides valuable assistance to British and offshore trading partners**.** There has been very little empirical research to objectively analyse the impact of offset agreements in developing countries, which would provide evidence to formulate future policies and develop best practices in offsets.

This paper attempts to provide a critical evaluation of Malaysia's offset practices and explore their impact on technological and industrial development The paper will also look at ways to harness available resources to increase the efficiency and effectiveness of offset practices in Malaysia. It will provide preliminary policy recommendations towards this end by drawing relevant international offset experiences in other parts of the world.

1. INTRODUCTION

Offsets have become a subject of growing importance both in global industry and in the arms trade. The US Department of Commerce Bureau of Industry and Security in its

March 2005 Report on offsets indicated that US prime contractors alone have signed 466 new offsets agreements totalling USD 50.7 billion from 1993-2003 as compared to total defence exports of USD$ 70.9 billion[12]. As offsets are clearly of some significance, we thus need to understand the nature of this trading phenomenon. Offsets are an economic enhancement package whereby the seller agrees to compensate the buyer for goods or services purchased[13]. Other terms used to refer to offsets include countertrade, industrial participation and economic enhancement. Offsets are cluttered with terminologies. Offsets can either be direct or indirect. Direct offsets involve all activities directly related to the equipment purchased such as co-production, licensed production, subcontracting, technology transfer and training. Indirect offsets involve activities that are not directly related to the equipment purchased such as marketing/export assistance, investments, purchases, training and technology transfer. This practice was initiated by the Western European countries during the period of the Second World War whilst nations worked to rebuild the international economy.

The need for offsets had increased in the post Cold War era due to a more difficult and competitive international defence market environment. The shrinking defence industry, continuous efforts of mergers and acquisitions and rising weapon costs due to greater technological demand and R&D activities has forced defence contractors to offer more attractive trade deals such as offsets. 'Smart' customers, on the other hand, realizing the economic benefits of offsets, have resorted to an 'arm twisting' approach in acquiring offsets. This practice is viewed as 'win-win' strategy by both sellers and buyers.

2. BENEFITS AND COSTS OF OFFSETS

Developed and developed countries require offsets for various reasons. Evidences indicate that the nature of offsets demand varies according to the objectives of the purchasing government and to certain extend the level of economic development[14]. Supporters view offsets as benefiting the purchasing countries in terms of creating an indigenous defence industrial base, advanced technological development, increasing defence-civil integration, especially job-creation, promoting exports, enhancing R&D and generally high value added backward linkages.[15] In a political sense, offsets are used to justify the huge outflow of currency is balanced via economic returns to the buyer countries. Critics claim offsets to be 'economically inefficient', 'market distorting', increases equipment cost thus further escalating defence equipment costs and that it takes away jobs and technology from the more advanced countries[16].

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[12] US Bureau of Industry and Security, (2005) , March

[13] see Ron Matthews (2003) "Home Guard", *Financial Management*, June ,p.23; see also Stephen Martin (1996) Economic of Offsets, Harwood Academic Publishers,p.31;Hall and Markowski (1996) "Some Lessons from the Australian Defence Offsets Experience" *Defence Analysis*, Volume 12(3),p.289-314

[14] United States General Accounting Office(2004) ' Defence Trade: Issues Concerning the Use of Offsets in International Defence Sales' July 8, p.3

[15] See Hirshman A.O, (1958) the Strategy of Economic Development, Clinton, MA and Yale University Press for poles of development argument on how defence production is meant to trigger 'backward and forward linkages' to other industries. See also J.Paul Dunne and Guy Lamb (2004) 'Defence Industrial Participation: The South African Experience in Jurgen Brauer and Paul Dunne J, (2004) *Arms Trade and Economic Development: Theory, Policy and Cases in Arms Trade Offsets*, Routledge.

[16] see also Jurgen Brauer and J Paul Dunne,(2002) "Saudi Arabia: Defence Offsets and Development in Arming the South": *The Economics of Military Expenditure, Arms production and Arms Trade in*

3. OFFSETS: THE CASE OF MALAYSIA

3.1 Background

Most developing countries view offsets as the ‘third wave’[17] towards technology acquisition. The newly industrialised countries, namely Korea, Singapore and Taiwan with high technology absorption capability have pursued this strategy to develop their technology and industrial base. Others, in the second tier of industrialization such as Malaysia view offsets as a major thrust for economic development and technology acquisition with a specific focus on defence technology spin-offs, skill development and sub-contracting work with a view to becoming part of the global supply chain network.[18]

Offsets[19] were first introduced to Malaysia through the purchase of Hawk aircraft from BAE Systems in 1992. However, Malaysia has been involved in counter purchase activities since the 1980s. At that time, it was managed by a special unit (UKC) set up by the Ministry of International Trade and Industry (MITI). After the economic recession, this unit was disbanded and its functions were transferred to the Ministry of Finance (MOF). From 1990 till 2001, offsets policy and implementation were carried out by MOF with input from operating ministries. In 2001, MOF decided to decentralize the management of offsets to six key ministries[20]. To date, the Ministry of Defence (MOD) is the largest beneficiary of the offsets programme.

Malaysia’s offsets strategy is quite similar to many other developing countries. It views offsets as a tool to acquire technological and industrial development via strategic partnerships, maximization of local contents, establishing a defence industry with through-life support capable of supporting its armed forces, obtain technology with strategic dual-use purposes and to develop its human resource in high technology areas. Malaysia does not have a written offsets policy/guideline offsets. Its offsets requirements are based on past practices. Therefore the requirement may vary form one procurement contract to another. Some contractors consider this a flexible approach yet others claim it as being less transparent.

As a general rule, offsets are imposed on all defence procurement above 10 million Euros. Offsets value may vary between 30-60%. The offsets agreement imposes a penalty with bank guarantees, normally between 5-8%. Multipliers are flexible

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Developing Countries, Palgrave; Martin S (Ed)(1996) *The Economics of Offsets: Defence Procurement Options for the 1990s* Harwood Press, London,p.54

[17] see also Michael W.Chinworth and Ron Matthews (1996) “ Defence Industrialisation Through Offsets: The Case of Japan” in Martin S (Ed)(1996) *The Economics of Offsets: Defence Procurement Options for the 1990s* Harwood Press, London,p.177-218

[18] See Richard A.Bitzinger, “Offsets and Defence Industrialisation in Indonesia and Singapore” in Jurgen Brauer and Paul Dunne J, (2004) *Arms Trade and Economic Development: Theory, Policy and Cases in Arms Trade Offsets*, Routledge,p.257

[19] In the case of Malaysia, offsets fall under the umbrella term of countertrade. The other main component is counterpurchase.

[20] The six key ministries are Ministry of Home Affairs, Ministry of Works, Ministry of Transport, Ministry of Education, Ministry of Health and Ministry of Defence.

depending on the value and importance of the project, which in some cases can be as high as 20. A larger proportion of offsets, are allocated towards indirect offsets. The government also stresses ‘additionality’ and ‘causality’ in offsets agreements

Defence offsets management falls under the prerogative of the Defence Industry Division (DID), MOD. The offsets unit is headed by a full colonel and assisted by an assistant secretary from the Administrative and Diplomatic service. is responsible for the operations of offsets. The offsets unit’s function is to accept offsets proposals, evaluate, negotiate, coordinate and monitor the progress and completion of offsets programmes. DID seek the advice of various Malaysian government and commercial entities during the evaluation process. An offsets committee headed by the Secretary General, MOD with members from various agencies was formed in year 2002 to formally evaluate and approve all offsets programme with the intention of increasing the transparency of offsets management. Unfortunately, the committee only convened once. To date, most offsets programmes have been approved on an *ad-hoc* basis by the Deputy Secretary General (Development) and Secretary General, after consultation with the Minister of Defence. However, offsets policy matters are still under the prerogative of the MOF.

Offsets also features as an important subject in all defence industry bilateral platforms, whereby, offshore vendors and Malaysian companies are blessed with opportunities to seek partnerships and strategic business collaborations before the actual procurement takes place. Besides, the Malaysian Defence Industry Council (MDIC) [21]also consistently monitors the development of offsets in Malaysia. This council constantly proposes way and means of increasing offsets effectiveness and efficiency.

3.2 **Impact Analysis**

In the case of Malaysia, it is unrealistic to claim that offsets had been a total failure, but neither have they been a complete success. In practice, offsets programmes represent a ‘mixed bag’. An impact analysis conducted through questionnaires with offsets beneficiaries, all of them defence related companies, revealed that offsets had the highest impact in terms of skill enhancement followed by sub-contracting , employment generation, profit increase, technology innovation, technology absorption for dual –use and finally potential for export. Skill enhancement were mainly in form of training to undertake the through life support of the equipment purchased, consultancy services to train officers in certain specialized technology. It was claimed that most of this training was classroom-based rather than a hands-on approach. Subcontracting work was mainly to produce parts and components such as pylons, composite parts, seats, tools and jigs which do not involve high end technology. However, the detailed figure on total profit and employment generation was not available as most of these companies tend to lump defence and civil work together.

[21] MDIC was formed in 1999 to ensure the coordinated development of defence industry in Malaysia. It is chaired by the Minister of Defence and the Defence Industry Division acts as the secretariat.

The research also revealed that as of 2004, Malaysia had acquired 43 defence equipment involving 430 offsets projects. Of this, 109 projects were direct offsets whilst 321 were directed towards indirect offsets.[22] However, to the contrary, in terms of offsets beneficiary[23], the local defence companies were the largest beneficiary with 40% followed by non-defence related commercial entities (30%), government organizations: mainly the armed forces and Science Technology Research Institute for Defence (STRIDE)[24] (25%) and finally universities and other research organizations (5%). This suggests that the defence related companies and government organizations have been the largest beneficiaries of offsets. More than 50% of the offsets were channelled towards training, followed by maintenance, repair and overhaul (MRO), manufacturing, sub-assembly with very minimal work into systems integration and research & development. Malaysia's offsets priority in the past has been to train human resource development in high technology areas especially aerospace and information communication technology as well as for second and third line MRO activities to maintain its equipments locally.[25]

3.3 Current Issues of Offsets Management

There are many unresolved issues in offsets management not least of which is the pending offsets policy/guidelines. After almost twenty years, Malaysia is yet to publish its policy/guidelines. A study conducted by Malaysian Industry Group for High Technology (MIGHT) in 2001, produced a Report outlining several recommendations to improve the offsets management as well as providing inputs to the guideline. However, except for the formation of the Technology Depository Agency (TDA)[26] under MIGHT, none of its other recommendations have yet to be implemented. The draft guideline was formulated by DID with the assistance of consultants from DESO, UK, Denel of South Africa and reviewed by the Offsets Guideline Committee headed by Economic Planning Unit (EPU) which was later send for MOF approval. However, the draft guideline is still pending due to several implementation issues that are yet to be resolved between the MOF and MOD. Most defence contractors claim to be confused due to inconsistent and lack of transparency in the overall offsets management. Yet, some of the other contractors claim this practice as being flexible, providing opportunities for creativity and maximum utilization of offsets for the country's

[22] It was not possible to give a figure as to the total offsets value as some of the earlier contracts did not have offsets value or percentage.

[23] A 3 month research was undertaken via an attachment with the Ministry of Defence, Malaysia to evaluate the impact on Malaysia's offsets programme. Overall, 17 local companies, 15 offshore vendors, 4 research organizations and 5 government agencies were interviewed.

[24] STRIDE or formally known as DSTC is the only organisation with the function to supply scientific and technical expertise to the Malaysian Armed Forces

[25] There have been criticisms from industry members that MRO and basic training should be part of the main contract and not included as offsets.

[26] TDA was formed after a cabinet decision in November 2002. MIGHT has taken over the managing of TDA since April 2004. TDA role is to ensure that technology acquisition meets the country's development objectives by compiling the country's technology wish list and linking the technology needs to Government acquisition.

benefits[27]. Overall, the absence of a policy, may, in the long run create losses for the government due to the lack of through-life planning, especially when there is high turn over of officers within the DID.

Another issue is that offsets have yet to be incorporated into Malaysia's national industrial, economic and technology related policies. It is still felt that the impact of offsets is very minimal and has no significant contribution to the overall economic development. This is also blamed on the lack of data and empirical evidence on its impact. Other issues related to offsets include the lack of understanding on the subject by officers handling offsets and those from the procurement project team. The high turn over of officers at the MOD calls for constant training on a subject which is highly technical and involves high negotiation skills to deal with offshore vendors.

A key issue in any new offsets proposal is that it has to be incorporated into the main tender document and negotiated in tandem with price and technical negotiations. However, there is still lack of coordination and awareness amongst officers within the procurement project team to do so. Offsets are normally left until the tail-end and negotiated in a hurry. Another unresolved issue is on the offsets implementation whereby there is lack of 'follow-up' and 'follow-through' after each offsets programme has been signed. It is normally easier to close an offsets deal but it is very difficult to see through the completion of the project.

Some of the enduring issues for the defence contractors include the lack of local industry absorption capability, not being given a free hand to choose their right partners, mismatch of projects whereby companies with no experience at all on certain technologies were assigned to undertake work, unwillingness of local companies to invest and take risks, and the lack of consistency and transparency in offsets management.

Difficulties faced by local companies include the claim that offshore vendors are not willing to part with their technology, very high royalty payments, inconsistency in the awarding of offsets, having to absorb huge investments for 'one-off' projects. Contractors fail to look at forging long term sustainable partnerships. Examples include the offsets programme for the ACV 300 from Turkey. DEFTECH was provided with technology transfer to carry out sub-assembly work but no future work has come though after the completion of the offsets programme. Another example is where Vickers Defence provided work to CTRM to manufacture composite rail for the single –span tactical bridge. However, after the completion of the project, the site is left abandoned with new work.

Finally, research organisations such as STRIDE claim that offsets do not provide sufficient allocation for defence related R & D. Non defence research organizations such as MINT is said to benefit more from the offsets deals. Offshore vendors are said to be happier to depart with non-defence technology as compared to sensitive defence technologies which they want to protect.

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[27] US based defence companies prefer to be given a free hand to design and package their offsets programme. Most of them are more comfortable to work without an official policy or guideline and claim to create offsets programmes based on the country's current economic needs.

4.CONCLUSION

Malaysia has taken offsets seriously since the 1990s and attempted to strike a good bargain by insisting on offsets obligations tied to its primary acquisitions. Malaysian offsets negotiators, having studied the models and experiences of many other developed and developing countries, have requested more indirect offsets. They realise that defence-related industry capabilities within the country is difficult to sustain over time as export opportunities are limited while domestic demands are small and often very capricious. Offsets have been largely used to develop Malaysia's human resources in specialized high technology areas such as aerospace, electronics and through life support of equipment purchased. The argument presented here could probably also apply to small and medium sized developing countries with lesser defence technology absorption capacity. It will simply not be rationalistic to convince such countries to drop offsets requirements, but to channel them towards indirect offsets. However, Malaysia has yet to maximize offsets fully for its economic development and indigenization goals. This could be due to the absence of a genuine technology and industrial policy incorporating offset- often giving rise to short term procurement and offsets strategies.

However, given the nature of offsets, it is difficult to evaluate the effectiveness and efficiency of the offsets programme towards economic development and indigenization considering the multitude of other determinants that can influence these goals. In the case of Malaysia, to ensure that the overall offsets management is carried effectively, several issues need to be reviewed including the procurement and offsets policy and process as well as the technology, industrial and human resource development strategy. In sum, to create long term 'sustainability', there must exists a suitable environment in which all players: the government, seller, subcontractors and research organisations work together based on 'best endeavours' rather than mandatory obligations.