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CONTRIBUTION OF OFFSET TO DEFENCE INDUSTRIALISATION IN INDONESIA

CRANFIELD DEFENCE AND SECURITY

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ABSTRACT

Offset is compensation given to a buyer country for an arms sale. Initially perceived as 'necessary evil' in an imperfect defence market, it now serves dual purposes: a marketing strategy for defence industry and a procurement policy for buyer country to generate add on benefits from arms import. Offsets proliferate, and so are stricter mandatory government policies. Still evaluation of offset has been difficult, mostly done in a country-based setting using anecdotal evidence that result in mixed findings. Following the issuance of mandatory offset policy in Indonesia through Law on Defence Industry in 2012, evaluation of past and current offset practice have become not only relevant but also critical to provide policy feedback. This dissertation provides an empirical examination on how offset has been understood and practised in Indonesia, and its contribution to defence industrialisation. The timeframe chosen is 1988-2014, when countertrade has been used to support the lifecycle of strategic industries: development (1988-1998), survival (1999-2009), and revitalisation (2010-2014).

This study derives its validity and reliability from triangulation, comprising secondary data, survey, and case study. Three variables are analysed: technology development through 'strategic industries', defence offset, and defence industrialisation. Technology development focuses on how technology policy centred on a strategic industries paradigm and ladder of production to initiate industrialisation push. Defence offset discusses the conceptual and practical aspects of offset in Indonesia, including strategic objectives, regulation and institution frameworksin the defence procurement context, and offset life cycle and financing. Defence industrialisation discusses the impact of offset through employment, skill enhancement, transfer of technology, export promotion, domestic supply chain creation, and R&D. Field works were conducted in three firms representing different industrial sectors: PT DI (aerospace), PT Pal (shipbuilding), and PT Pindad (landsystem).

Research findings indicate that, first, offset practice has mostly taken place on an ad hoc basis, with no clear reference to strategic objectives, as well as long-term management and financing- that mirror deficiencies in defence procurement. Second,

as result of the deficiencies, offset results have been varied from one firm to another, across the different industrial sectors of aerospace, maritime, as well as ammunition and land system. While offset has a positive impact on skill enhancement and technology transfer, it seldom translates into new employment, supply chain creation, export, or R&D.

This study generates the following recommendations. First, Indonesia needs to strengthen the management of offset through pre-offset planning and preparing practical guidelines for offset stakeholders in parallel with human resources to support the programme. This means identification of offset potential in procurement (convergence of long term technology policy and long term defence procurement plan), estimation of offset premium cost, allowing participation of industry in the early stage of the offset cycle, as well as devising methods of evaluating offset. Second, Indonesia needs to formulate strategic objectives for offset that relate closely to the dual purposes of defence modernisation and industry revitalisation. Third, Indonesia must strengthen the technology absorptive capability in industry in order to sustain the benefit of offset.

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I dedicate this thesis to my parents, Ibu dan Bapak. Everything that I am now is because of you.

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LIST OF ABBREVIATIONS

ABRI: *Angkatan Bersenjata Republik Indonesia* (Indonesian Armed Forces)

APS/APC: Armoured Personnel Carrier

BAPPENAS: *Badan Perencanaan Pembangunan Nasional* (National Development Planning Agency)

BPIS: *Badan Pengelola Industri Strategis* (The Agency for Management of Strategic Industries)

BPPT: *Badang Pengkajian dan Penerapan Teknologi* (Agency for the Assessment and Application of Technology)

BARANAHAN: *Badan Sarana dan Prasarana Pertahanan* (Defence facilities Agency)

BUMN: *Badan Usaha Milik Negara* (State Owned Enterprise)

BUMNIS: *Badan Usaha Milik Negara Industri Strategis* (State Owned Enterprise Strategic Industries)

DCs: Developed Countries

DIT TEKINHAN: *Direktorat Teknologi Industri Pertahanan* (Directorate of Defence Technology and Industry)

DITJEN POTHAN: *Direktorat Jendral Potensi Pertahanan* (Directorate General of Defence Potential)

DI: *Dirgantara Indonesia* (Indonesian Aerospace)

DPIS: *Dewan Pembina Industri Strategis* (The Council for Management of Strategic Industries)

FDI: Foreign Direct Investment

FPB: Fast Patrol Boat

GDP: Gross Domestic Product

GPA: General Procurement Agreement

IFV: Infantry Fighting Vehicle

IPTN: *Industri Pesawat Terbang Nusantara* (Nusantara Aerospace Industry)

KEMRISTEK: *Kementrian Riset dan Teknologi* (Ministry for Research and Technology)

KEMHAN: *Kementerian Pertahanan* (Ministry of Defence)

KCR: *Kapal Cepat Rudal* (Missile Fast Boat)

KKIP: *Komite Kebijakan Industri Pertahanan* (Committee for Defence Industry Policy)

LPD: Landing Platform Dock

LDCs: Late Developing Countries

MEF: Minimum Essential Forces

MILEX: Military Expenditure

NATO: North Atlantic Treaty Organisation

NIB/NICs: Newly Industrialised Countries

PKR: *Perusak Kawal Rudal* (Guided Missile Destroyer Escort)

PMP: Progressive Manufacturing Plan

REPELITA: *Rencana Pembangunan Lima Tahun* (Five Year Development Plan)

PELITA: *Pembangunan Lima Tahun* (Five Year Development)

RENSTRA HANKAM: *Rencana Strategis Pertahanan Keamanan* (Strategic Plan on Defence and Security)

RPJMN: *Rencana Pembangunan Jangka Menengah Nasional* (National Medium Term Development Plan)

R&D: Research and Development

SMEs: Small and Medium Enterprises

TNI: *Tentara Nasional Indonesia* (Indonesian National Defence Forces)

WTO: World Trade Organisation

1. THE PHENOMENON OF DEFENCE OFFSET

1.1 Making the Case for Study

The study attempts to evaluate the contribution of defence offset to Indonesian defence industrial strategy. In pursuit of this goal, the study needs to overcome the challenge of clarifying the true contribution of offset in the midst of the complex economic-political-military settings of Indonesia. Thus, the study will focus on two key issues. The first is to examine technology development in Indonesia where strategic industries are used as vehicle for accelerated industrialisation, and defence offset is used as part of a conduit for technology transfer to support them. The second is to evaluate the contribution of offset to strategic industries across three different periods of industrialisation: development (1988-1998), survival (1999-2009), and revitalisation (2010-2014).

The study begins with an explanation of the major methodological and conceptual issues necessary to address the fundamental questions in this theoretical and empirical study. These questions include the research question/problem, why it is important, and what is the potential contribution the research makes to the existing academic body of knowledge and professional practice. This introductory chapter will also review the overall process of research, from defining the question/problem to choosing the appropriate methods, collecting and analysing data, and finally, to offering conclusions and providing recommendations. In a nutshell, this chapter will provide the essential academic fundamentals for the reader to understand the purpose, significance, and method of the study.

1.2 Growing Phenomenon of Offset

The birth and proliferation of offset, defined as industrial compensation required by government in the procurement of arms, is closely related to the United States' need to transfer military technology to its transatlantic allies for the purpose of defence readiness and standardisation in the post World War II period.[1] Co-production and offset that emerged in the 1970s in Europe then grew considerably as European countries – enjoying raised economic performance after the impact of war- were willing to pay a premium cost associated with licensed-production for technology transfer.[2] Demand for offset continued to rise as developing countries across the world sought to use offset as an industrial policy tool, hoping that technology transfer to domestic industry would produce a trickle-down effects to the whole economy. Transfer of technology through licensed-production, and later co-production, became the major offset requirement for both European and developing country defence industries alike.[3] By the 1990s, the Revolution in Military Affairs (RMA) -pioneered by the US and soon adopted by its counterparts- also affected the way offset proliferated. RMA emphasised the importance of technology in military hardware, while the gap in defence research and development between the US and the rest of the world was widening. As a consequence, defence industries in smaller economies found it unaffordable to operate a self-sufficient defence industry. Countries were beginning to seek cost reduction in the form of collaboration and access to expert networks. Hence, offset started to be used to establish partnership in research and production network.

The value and significance of offset have increased overtime, a testimony to its growing importance in the arms trade. Between 1993-2008, the US Department of Commerce's Bureau of Industry and Security (BIS) reported that the number of countries demanding offset and the numbers of companies entering into offset agreements had increased, as had the value of offset agreement as a percentage of contract value.[4] Some 48 US firms were reported to have entered into 677 offset arrangements with 45 different countries, all linked to defence export sales totalling US$97.13bn.[5] The European Defence Agency (EDA) also acknowledged growing offset practices, as they became the preferred choice of EU member states,[6] but then the EU in 2009 decided to ban the practise among its members.

Countries used different terms to refer to offset activities in country policies, such as Industrial Participation Programmes (United Kingdom), Industrial Benefits (Belgium), Industrial Cooperation (Denmark, Taiwan), National Industry Participation (South Africa), Industrial Capability Programmes (Australia), and so on. However, this is a semantics issue, as regardless of differences in the designation, offset is offset, whatever the terminology used. Some countries codify offset policy; some have not, instead relying on negotiation skills to generate optimal benefits.

Offset policy normally consists of a minimum offset requirement, minimum value of contract, an agreed delivery term, multipliers, penalties, a focus on particular activities, direct or indirect and eligible offset activities; and, if applicable, a dedicated agency specially formed to manage offset. Offset requirements also vary, with some countries like Denmark, Canada, South Africa and Switzerland aiming for 100% of the procurement contract value, or even higher, whereas others like New Zealand, Norway, Israel, South Korea and Saudi Arabia aim for a more modest offset target of around 30%.

The US Bureau of Industry and Security report on offset and the EDA report identify a correlation between the levels of development of the buyer country with the kind of offset it demands.[7] These Reports argue that developed countries tend to negotiate for direct offset- that is offset related to the purchased arms - rather than indirect – that is offset unrelated to the purchased article - whereas the developing countries prefer the latter indirect offset.

For the purpose of generalisation, this study assumes that the correlation between the level of development and offset demand is as follows:

1. Developed countries with established defence industries use offset to channel work or technology to their domestic defence companies; research on European countries' offset policies has revealed that offset provides industrial opportunities to create partnerships with large foreign system integrators.[8]

2. Newly industrialising economies use offset for both military and development purposes. Research on East Asian countries' offset practices have shown that they use offset to channel technology into their defence industrial base, which they view as a means of injecting advanced technologies and providing trickledown effects into the economy as a whole.[9]

3. Developing countries with less industrialised economies generally pursue indirect offset to help create profitable commercial business and to build their infrastructure, mostly because these countries do not have sufficient defence industrial base to absorb the benefits of direct offset.

The term NICs was first coined in the 1970s with the rise of the four Asian tigers with vibrant economies: Hong Kong, South Korea, Taiwan and Singapore. Later on, the term was also used to describe a larger group of countries enjoying thriving industrialisation, including South Africa, Mexico, Brazil, China, India, Malaysia, the Philippines, Thailand and Turkey. Indonesia has been mentioned as well as part of this dynamic group, but not in a consistent manner.[10] There is no common definition for NICs despite attempts to generalise their economic characteristics and performance. These characteristics include an export-oriented economy, diversification of export, and a growth rate of manufacturing that exceeds that of developed and lower-income developing countries.[11] LDCs is a term used to refer a group of country that lag behind the NICs in terms of output and income.

1.3 Offset: The 'Third Way' for Developing Countries?

Offset is relevant to industrialising countries, especially in Asia, for a number of significant reasons. First, defence industry is important for some NICs that have experienced a different politico-military context in the post Cold War period from that of developed economies in the western hemisphere. As contrary to the peace dividend in Europe, East Asian NICs remain concerned with security issues that were suppressed under US-Soviet rivalry but re-emerged soon after the Great Power's force reductions that created a vacuum of power. In Southeast Asia, longstanding territorial disputes kept countries on guard. Hence, for Asian states, arms industries remained strategic to ensure self-reliance and security of arms supply. South Korea and Taiwan, for instance, have been facing constant external threats that more or less justify the need to maintain a strong defence industrial base. Indonesia's experience with embargos (1960s and 1992-2005) crippled its disaster relief in the aftermath of 2004 Tsunami, and ignited sentiment for self-sufficiency through revitalisation of defence industry.

Second, there has been a significant rise in arms procurement spending in Asia due to strong economic performance that coincided with military modernisation programmes, as well as a changing strategic environment mainly affected by the rise of China. IISS recorded that the planned global defence expenditure in 2014, Asia and Australasia accounted for 21.4 percent or second only after North America.[12]

Bigger purchasing power and access to more advanced technology provides more opportunity for offset. Frost and Sullivan noted that a number of high value military offset deals are expected to flow from massive procurement programmes in Asia Pacific and the Middle East.[13] In the past, Asian NICs like South Korea, Taiwan, Singapore, and Indonesia, have used offset to support the indigenisation of defence industries. It is suggested that direct offset and indirect military offset helped to quicken the process of defence industrialisation and arms manufacturing to some extent.[14] As a consequence of past experience and current opportunity, offset is predicted to grow bigger and bolder in Asia.

Going further than just utilising offset for indigenising defence production capability, NICs also seek to transfer new technologies gained from defence offset into the broader domestic economy. Many developing countries have seen defence spending in another light, not as a 'burden' of an unproductive sector, but on the contrary, as a facilitator of economic growth.[15] In addition to the political motive of strategic sovereignty, developing countries seek to obtain the economic benefits from sustaining a defence industrial base: defence programme potentially contributes to the strength of the overall economy through 'spin-off', which assists in technology transfer, and upgrade skills and the productivity of labour.[16] In this light, offset has been seen as 'third way' for industrialisation.

There are number of ways in which offset can help economic development: offset can bring in fresh flows of investment capital, create opportunities for work that would increase skills, channel the transfer of technology from advanced to developing country, and so on.[17] According to the US Department of Commerce's Bureau of Industry and Security (BIS), the trend of offset during 1993-2008 showed that approximately sixty percent of offset is in the form of indirect offset, as opposed to forty percent in direct offset. This distribution of offset is linked to strategic economic development policy, where countries try to divert the benefits of offset to construct comparative advantages in sectors with greater income elasticity and growth potential.[18] The same preference is shared by new and small European Union countries, which prefer to acquire greater civil offset compared to their more advanced counterparts.[19] The use of offset in Saudi Arabia, for example, has channelled the transfer of technology to commercial sectors, helping to broaden the country's export portfolios beyond petroleum. Another interesting case is Indonesia, where the transfer of technology into dual-industries was used as part of a grand strategy to enable an economic 'take-off' from an agricultural and manufacture-based economy into a high tech-based society to escape from dependency on oil exports.

1.4 Indonesia's Offset: the Tale of Habibie, Soeharto, and Strategic Industry Champions

Until recently, offset was not a familiar term for Indonesian defence stakeholders. This is intriguing because Indonesia had been hailed as a pioneer in countertrade and offset since the 1970s, and was among the first developing countries outside the Soviet Union to establish comprehensive countertrade regulations in 1982.[20] While countertrade found its way into the Indonesian language as 'imbal dagang', offset cannot be found anywhere in recent government policy aimed at regulating procurement. The closest terms to offset are 'transfer teknologi' (technology transfer) and 'kandungan lokal' (local content).[21]

To understand offset practice and dual-use policy in Indonesia's industrial strategy, one cannot neglect the influence of B.J. Habibie and Suharto. Suharto was the former Indonesian president (1966-1998), who envisioned a giant leap in order to short cut the development process so that he could create a high-tech based economy by the end of the fifth term of five-year development plans (1994-1998). It was Habibie who turned Suharto's idea into a great experiment and gave birth to the creation of the Indonesian research and development sector and high-tech industry. If Suharto was hailed as the 'father of Indonesian development' - despite controversy surrounding his family corruption - Habibie was hailed as the 'father of Indonesian technology'. Being a devoted Muslim, Habibie delighted the Muslim majority with his concept of embracing science and technology together with what Islam believes as '*imtaq and imtek' (faith and devotion are inseparable from science and technology).* An engineer by training, Habibie brought with him a new approach to economic thinking that emphasised investment into high-tech sectors and the creation of competitive advantage, known as 'Habibienomics'.

Habibie's strategy encompassed four components: technology transfer through offset; a product portfolio emphasizing 'dual-use' technology; the creation and sustainability of key industrial growth poles - termed 'strategic industries' within the defence economy; and an institutional arrangement for technology development. [22] The first strategy was encapsulated in Habibie's philosophy "begin at the end, end at the beginning",[23] meaning that technology development in the production cycle and design process should be the first priority in setting up industry. The quickest way to get transfer of technology would be through license-production; in other words, offset.

The second strategy was about having a dual-use industry. Indonesia does not have an exclusive defence industry, but rather an industry with dual-use products for both commercial and military purposes, commonly categorised as 'dual-use industry'. It was understood that in peacetime, the commercial leg of the industry would account for eighty percent of production capacity whereas the defence leg would represent the other twenty percent. During war this arrangement would be reversed, with defence divisions accounting for most of the production capacity. For example, PT IPTN manufactured transport aircraft that could be used for both civil and military purposes, PT Pindad produced commercial explosives for mining and petroleum industries, and PT PAL built merchant ships.

The third element of Habibie's strategy was aimed at creating a pool of strategic industries. Suharto himself handpicked fourteen industries deemed as 'strategic' through Presidential Decree No.44/1989, some of which used to be under the management of the Armed Forces to support the maintenance of military systems. Two industries were to be the spearhead of the 'transformation' process: aerospace (PT IPTN) and shipbuilding (PT PAL). The argument behind this was the vital role of Indonesian transportation to overcome the geographical barriers of the archipelago. Other industries like metal, chemical, heavy machineries, communication and so on, were considered as supporting industries or part of the supply chain for the strategic industries, which in turn were treated as infant industries, enjoying protection and subsidy until strong enough to stand on their own feet.[24]

The fourth element was concerned with establishing the research and development sector in Indonesia, and also the techno-nationalism ideology. The Agency for Assessment and Application of Technology (*Badan Pengkajian dan Penerapan Tecknologi*, hereafter referred to as BPPT) was created in 1974, with responsibility to formulate the technology development roadmap and conduct research and development. Through the strategic industries, Indonesia would shorten the industrialisation course and speed-up development while at the same time, securing sovereignty and security through indigenous arms provision.[25]

1.5 The Rise and Demise of Offset in Indonesia

Indonesia presents an interesting case study for many reasons. It is a democratic country with the biggest Muslim population in the world, yet also a pluralistic state, embracing over 200 different ethnic races. It is an archipelagic state stretching along the equator, with more than 17,000 islands strategically located between two regions (Asia and Australia), and two oceans (Indian and Pacific Ocean). Indonesia is also the biggest country in Southeast Asia, in terms of territorial size and population. In every way, be it population, geography or ethnicity, Indonesia is a unique nation-state. In terms of economic progress, Indonesia has moved from a newly independent country to enter the exclusive club of growth-leading NICs during the 1990s, and then back to the status of a low-income developing country in the post-1997 economic crisis.[26] Today, Indonesia has gained the status of the world's 16th biggest economy and joined the exclusive G-20, and potentially could surpass Germany and UK to become the world's 7th biggest economy in the next 15 years.[27]

Due to its size and population, it is imperative that Indonesia plays a significant role in the regional and international arena. Indonesia has a long history of leading diplomacy in anti-colonialism in the post World War II era, pioneering the non-alignment movement during the Cold War period and the Organisation of Islamic Conference, as well as being the founding father of the Association of Southeast Asian Nations (ASEAN). It is only natural to see Indonesia's diplomatic role growing hand-in-hand with its military power, through which Indonesia can contribute to UN peacekeeping operations, as has happened in Cambodia, Congo, Lebanon and many others. With a free-and-active philosophy underpinning its foreign policy

(*Politik Luar Negeri Bebas-Aktif*), Indonesia refuses to tie itself to alliances and insists on self-reliance. To ensure this strategic sovereignty is maintained, the government established state-owned dual-use industries in the 1970s to produce both defence equipment and commercial products, using offset as one of the strategies.

Through government-to-government purchases under the Foreign Military Sales scheme and development aid since the 1970s, Indonesia has been able to extract offset arrangements - ranging from license-production to buy-back - to support defence industrialisation. Three main strategic industries within the defence sector, PT IPTN (later renamed as Indonesian Aerospace), PT Pal (shipbuilding) and PT Pindad (land systems), entered into collaborative agreements with US, European and Asian countries. Throughout 1983-1993, the three industries accounted for IDR 1.1trillion (USD1.2bn) worth of defence procurement, supplying fixed wing aircraft and helicopters, fast patrol boats, attack rifles and ammunition.[28] Furthermore, Indonesia was also listed among the major arms exporting developing countries in the world in the SIPRI yearbook during 1981-1985.[29]

The demise of offset began when Indonesia was hit by a 'multi-dimensional' crisis in 1997, which started as economic in nature but delivered a devastating blow to political stability, hence giving birth to *reformasi*. The Rupiah currency rate to the US dollar plunged 70% in a one-year period (1998-1999), and Jakarta lost much of its Foreign Direct Investment (FDI).[30] Jakarta was also forced to cut off funding for IPTN and other state-run industries to meet conditions set by the International Monetary Fund (IMF) for a $43 billion bail-out of the financially stricken Indonesian economy.[31]

Suffering from a sharp decline in defence spending, from 9% to 3.7% of the government budget, Jakarta was forced to scale back, reschedule and even cancel defence procurement.[32] This source of revenue for strategic industries was severely cut, and the strategic industries had no choice but to look to overseas markets. Some strategic industries, like PT DI, still had competitiveness to secure overseas open bid tenders.[33]The subsequent years had been painful, though, as the strategic industries were forced to undergo rationalisation, reduce thousands of employees and shut down facilities to the point that PT IPTN and PT PAL were declared in court to be bankrupt.

Between 1993 and 2006 there were no offset contracts reported, suggesting that the Indonesian government may have decided to abandon offset. Putting aside the modest procurement that Jakarta had made through this period, challenging economic pressures had forced the Indonesian government into looking at alternative payment methods- most prominently export credit. Indeed the 'strategic gap' between procurement demand and approved defence spending expanded in subsequent years, despite efforts to raise the budget as a percentage of GDP. To turnaround the financial barrier, the government started to use other mechanisms other than foreign currency reserves, such as countertrade, export credits (from foreign banks) and loans from local banks, to support defence procurement funding.

Belatedly, there has been an effort to rejuvenate offset policy. The impetus for this is the government programme to revitalise the ailing defence industry under President Yudhoyono. His administration viewed the modernization plan as an opportunity to provide work for the local industry. A twelve year US arms embargo had crippled Indonesian Armed Forces capability, i.e. none of the naval vessels were combat ready in 2002.[34] Also, the modernisation plan of TNI meant that huge amounts of arms spending would likely go abroad if local industry were not to act as a supplier. The revitalisation of defence industry became a priority under Yudhoyono's second Presidency term (2010-2014). The Committee for Defence Industry Policy (*Komite Kebijakan Industri Pertahanan*, hereafter referred to as KKIP) was created to manage the revitalisation, importantly to formulate a national strategic policy in the defence industrial sector. This led to pressure for the government to issue a mandatory offset clause, with a view to creating a package of essential regulations.

1.6 Research Aim and Enabling Objectives

Every research proposal needs either a research question or a research problem, depending on the purpose of the research itself. This study chooses to employ a research question. The specified research question is basically an attempt to answer the 'what' aspect of this study.

The general question that encompasses this study is "how is offset implemented in Indonesian arms procurement and what contributory role does it play in support of technology indigenisation in three strategic firms in Indonesia through 1980s-2014?". The study specifically aims to evaluate the implementation of offset in the strategic industries by using three case studies of the lead industry integrators in arms production, namely: PT IPTN/DI, PT PAL and PT Pindad. Analysis will be divided into three time periods in accordance with the growth stages of the strategic industries: development (1988-1998), survival (1999-2009) and revitalisation (2010-2014). This stage methodology also highlights the timing of when offset was on the rise, in the process of decline, and finally during the upswing period.

The specific aspects that this study will explore are listed as the enabling objectives as follows:

A. Critically review the concepts of development, industrialisation and technology transfer borrowed from the development economics discipline, revolving around the need for developing countries to pursue a catch-up industrialisation strategy (ch 2)

B. Critically review the literature on the conceptual and empirical aspects of offset as well as the methods to evaluate offset implementation against policy objectives and strategies (ch 3)

C. Conduct an appraisal of Indonesian development strategy and government policy towards technology development through the targeting of strategic industries (ch 4)

D. Analyse the Indonesian version of catch-up industrialisation, dubbed as the Progressive Manufacturing Plan, and the military modernisation context which becomes the pretext for offset utilisation through defence procurement policy (ch 4)

E. Evaluate the practice of offset in the Indonesian defence sector, and identify the actors, policy and processes that shape the implementation of offset (ch 5)

F. Examine the implementation of offset to the strategic industries through nine sub case studies (ch 5) representing aerospace, land systems, ammunition and maritime, and analyse the contribution of offset to Indonesia's industrial indigenisation (I3) (ch 5)

G. Contribute recommendations to inform the implementation of Indonesia's upcoming offset policy (ch 6).

1.7 Study Value: The Contribution to Knowledge

The study attempts to answer the 'why' question. Why is the topic deemed appropriate, and what is the potential contribution of the study? There are three general areas that a study can be of significance: first, to contribute to knowledge in the research area (defining the current literature gap in particular, and the body of knowledge, in general, including the theoretical contribution); second, to contribute to policy considerations through the listing of recommendations for government action; third, to contribute to practitioners by exposing them to lessons learned from the past implementation of offset in Indonesia, as well as lessons learned from other countries.[35]

The study seeks to fill in the gap in the literature on offset as a tool of industrial policy for NICs and LDCs, in general, and to contribute to offset policy that the Indonesian government is formulating at the time the study was conducted. A study on offset in Indonesia is important as a means of obtaining a clearer picture of offset effectiveness in developing countries. Studies on offset usually takes form of case studies of individual countries, aims at providing idiographic explanation rather than a general explanation. Only few studies have attempted to approach offset by using a cross-countries analysis.[36] The study does not seek to do the latter, arguing that a case study would already be difficult enough to undertake due to the contextualised political and cultural settings in acountry. The contribution of a single case study on Indonesia to the body of literatures on offset is therefore akin to adding a piece to an incomplete mosaic: it may not solve the riddle yet, but it will give a better understanding on the overall offset conundrum.

Many of the publications on the Indonesian strategic industries are focused on the centrality of Habibie's role and technonationalism debate[37] between two opposing 'development schools' in Indonesia known as *Widjojonomics* and *Habibienomics* (although the latter is actually an engineer not an economist)[38], and study on the competitiveness and offset exclusively focused on the Indonesian Aerospace industry.[39] Perhaps this lack of literature can be attributed to the failure among academics to see strategic industries beyond being Suharto's toy or prestigious project; hence there is limited genuine interest to study the topic. But most importantly, the difficulty of getting quantitative data definitely contributes to the constrained interest among academics.

In the past years, there are two catalysts for more research in the offset area: first, more transparency has been introduced into state-owned companies, thus opening up access to primary data; second, the creation of the Indonesian Defence University has led to a greater empirical quest for defence data. During the course of this research, three Masters Theses have been written on offset, a testimony to the growing significance of the subject. The thesis by Seszy Yunioritta and Annisa Febriyanti attempted to evaluate offset contribution to PT Indonesian Aerospace and PT Pindad,respectively, while the thesis by Sriyanto aimed to evaluate the readiness of PT Pal in receiving offset linked to the procurement of the guided missile escort destroyer. [40] These theses share similar weaknesses: trying to evaluate offset's contribution to Indonesian defence industry in the absence of 'context'.

First, no thesis has yet been able to explain what is the strategic objective of offset throughout different defence industrialisation periods in Indonesia. Without this knowledge, evaluation of offset effectiveness will have no reference. Most theses focused only on the first stage of defence industrialisation. Second, these theses did not offer explanation on the offset lifecycle: how offset was planned, executed, and evaluated against the context of procurement. In other words, the explanation from cradle to grave regarding the decision to use offset has been missing in prior research. This is one of the important lacunas that this research seeks to address.

Second, it is important to make a contribution to the ongoing offset policymaking in Indonesia. As mentioned earlier, the revitalisation of defence industry has become the priority of the incumbent President's cabinet and supported by the parliament. This plan is inseparable from the Armed Forces long-term development plan issued in 2009, which became the basis of defence procurement for the next twenty years. Transfer of technology, co-production and joint collaboration are said to be the prioritised strategy for defence industry revitalisation. Following unsuccessful attempts to generate offset from the procurement of four corvettes from the

Netherlands in 2007,[41] there was concern that without a clear offset policy in place, Indonesia would not be able to optimise the benefits for local industry from arms imports.

The first official statement on offset as a mandatory policy imposed on foreign arms suppliers was stated in 2010, when the incumbent Deputy Defence Minister Sjafrie Sjamsudin said that "Indonesia will insist on tying every weapon purchase from foreign countries with a transfer-of-technology and joint-production scheme". Furthermore, he stated, "Indonesia would demand a 40 percent share in the production of the weapon's component or parts".[42] The statement was bold, considering the absence of offset-related policy and the lack of socialisation of the idea within the Department of Defence at the time of the announcement.[43] In December 2010, the Ministry of Defence initiated the first seminar on offset, aiming to produce a policy paper as inputs for KKIP. Jakarta aimed to have an offset policy by 2011, but in stages. It is hoped that the result of this study should be a valuable contribution to governmental attempts to formulate an offset policy, as it will shed light on the practice of offset over many years.

Third, the study hopes to deliver a contribution to practitioners. In this case, practitioners refer to the civil servants and workers in the defence industry, who will be involved in the offset negotiation and implementation process in the future. Preliminary interviews suggest that despite decades of offset experience, there is only minimal or even no knowledge of 'lessons learned' regarding past offset negotiations incorporated into the knowledge system of Indonesia's MoD.[44] Furthermore, the unsuccessful offset project in 2007 with PT PAL revealed a discouraging fact: that the negotiators of offset and industry could have different views on which type of offset activity should be obtained from the corvette deal.[45] Clearly, then, there is need to evaluate the objectives set by the government and the expectations of industry, and how the gap between them can be addressed to help revitalise local industry.

1.8 Conceptual Framework

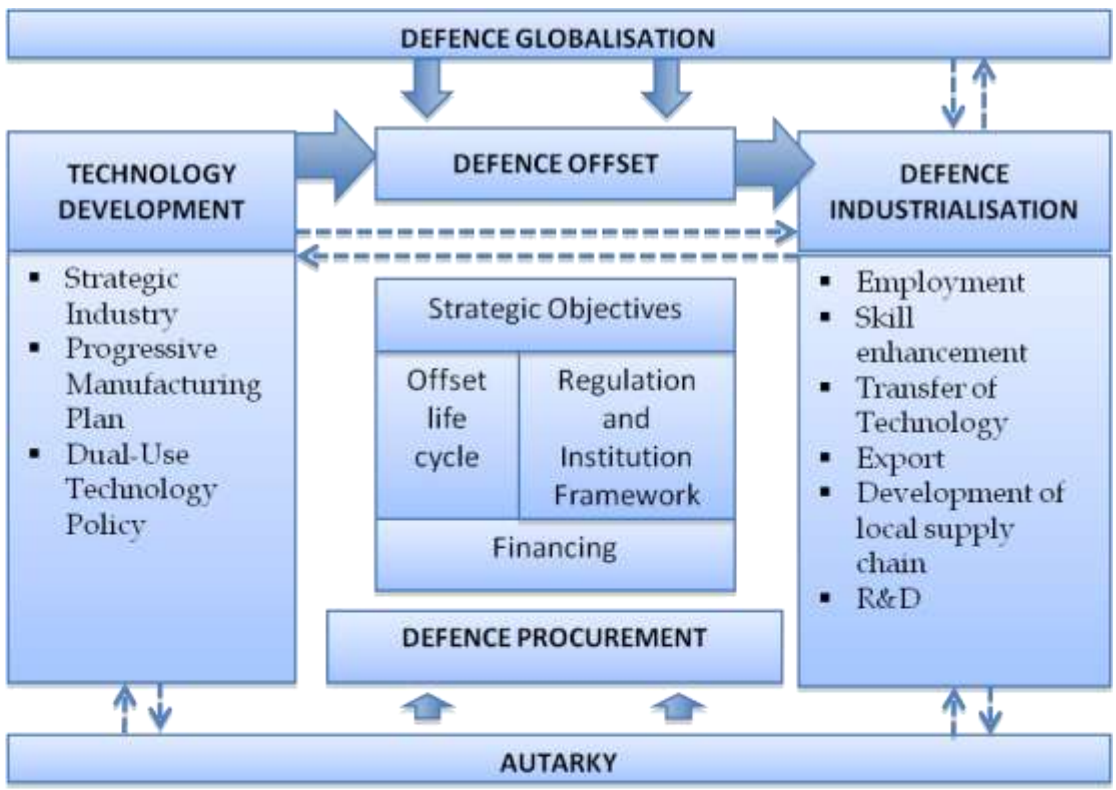
A conceptual framework is an elaboration of the research question in relation to the relevant literature. Figure 1.1, below, offers a conceptual model for this study. It has generic application, in the sense that all defence industrialising countries face the same dilemma between "make" (represented by autarky) and the more cost effective "buy off the shelf" option (represented by globalisation). In the past decades the policy resolution to this dilemma has been technology absorption or using public procurement for innovation policy. At the heart of this concept has been an emphasis on a government interventionist role; that is, targeting specific sectors in defence for protection and subsidy. However, in light of rising unit production cost of arms and a tighter IPR regime, the autarky choice comes with high cost, risk and is a lengthy process.

Indonesia pursued this model of technology development in the 1980s, targeting strategic industries with infant industry protection, transfer of technology through a progressive manufacturing plan, and a dual-use portfolio. This model was halted by the 1998 economic crisis that diminished the state's financing ability. In the search for cutting edge weapon systems at low unit cost, the Indonesian authorities had been made to realise the high opportunity costs imposed by the pursuit of local defence industrial development. However, there was an even more important policy recognition in the latter part of the 2000s that globalisation, whilst bringing the benefits of cost effective acquisition, also carried the inevitable downside of the erosion of national autarky; that is, the loss of defence industrial sovereignty.

The current international arms market, characterised as 'buyer's market', offers an alternative pathway to resolving the globalisation-autarky dilemma, and that is by focusing on offset policy. Offset in arms procurement is the combination of synchronised strategic objectives between arms procurement and domestic technology development, supported by regulation and an institutional framework, with adequate financing to provide scale, implemented in parallel with the procurement life cycle. Here, expenditure on defence technologies also represents expenditure on broader industrial and technological development both in defence and the commercial sector. This is illustrated in figure 1.1 as a rightward movement from technology development to technology indigenisation in defence firms, using offset in arms procurement as the conduit.

It is assumed that defence offset can contribute to the process of defence industrialisation, serving both the needs for autarchy and benefiting from defence globalisation. The progress in defence industrialisation will arguably expand defence industrial sovereignty over time, hence serving the strategic interests of state defence. Defence industrialisation also enables the industry to connect with international players; for example, through joint-ventures and as part of a global supply chain, hence amassing more opportunity to enhance competitiveness and close in the technology gap with more advanced countries. This in turn will also have positive impact on technology development in general.

Figure 1.1 Indonesia's Defence Industrial Model



Source: Author

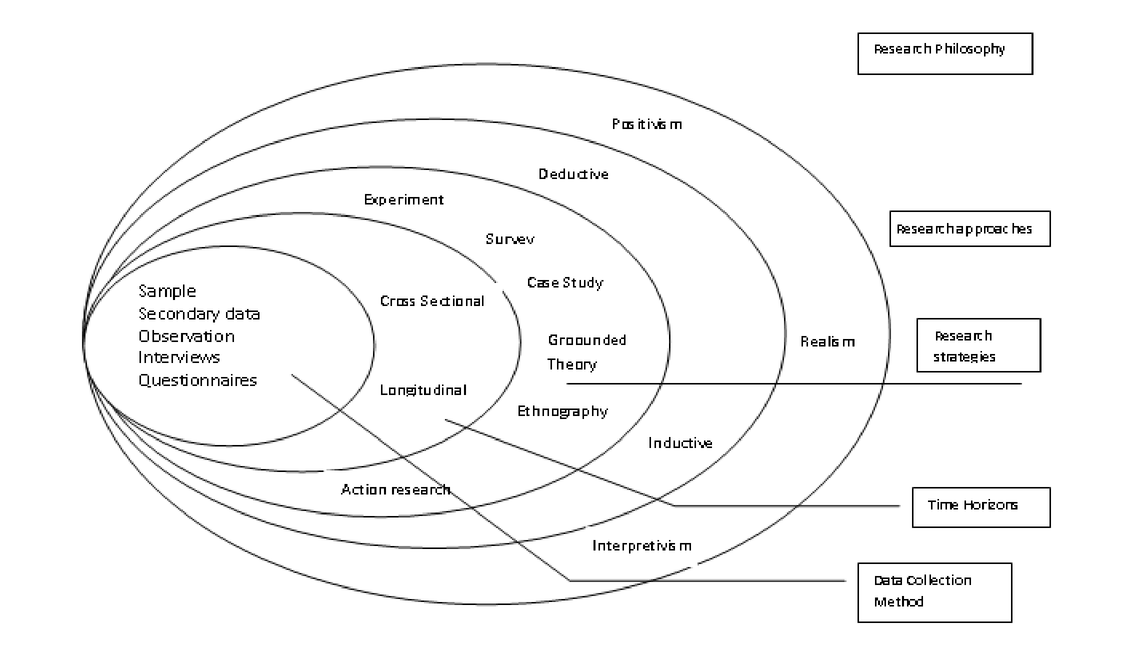
Thus, at the core of the Figure 1.1 conceptual model is an analytical framework aimed at profiling the impact of defence offset on the development of a national defence industry. It can be seen that the pursuit of defence industrialisation via an offset policy can be directed towards six variables: employment creation; skill-enhancement; the transfer of technology; export promotion; the development of local supply chains; and R&D.

This analytical framework represents the structure of Chapter 5. The academic building blocks to this analysis are provided by the discourse set out in Chapter 2 ('technology development' literature), Chapter 3 ('defence offset' strategies), as well as Chapter 4 (Indonesia's 'technology development' context).

1.9 Research Methodology

This section attempts to answer the 'how question' by explaining what kind of research methodology is employed in the study. In order to undertake this task, the study will first explain the epistemological debate in research methodology and continue to peel each layer of research onion, from the most abstract (research philosophy) to the most operational (data collection methods). For this purpose, the study employs a research 'onion' process proposed by Saunders, Lewis and Thornhill (Figure 1.2).

Figure 1.2 The Research 'Onion'



Source: Saunders, M., Lewis, P., and Thornhill, A. (2003) *Research methods for Business Students*. Pearson Education Limited.

Research goes beyond collecting and assembling facts; it involves a series of systematic methods in data collection and interpretation in a scientific way, so that the results can be scientifically justified. Methodology is a body of methods, rules and postulates employed by a discipline, a particular procedure or a set of procedures;[46] it is the fundamental thing by which research can be differentiated from other kinds of inquiry, because methodology gives the scientific basis to research. Putting all this together, research methods aims

> "... to effect a link between the empirical world and its theoretical conceptions. By examining the world in a systematic way we can access the adequacy, plausibility, accuracy, fruitfulness, truth even, the theories about the world."47

There are two great traditions of research methods in scientific endeavour; quantitative and qualitative. Both traditions offer the potential means of addressing a research problem, in different ways. Quantitative methodology emphasises the use of numbers as measurement or indicators of relevant variables to help researchers make sense of their research problem. The qualitative method emphasises making sense of a problem in its natural setting, through interpretation of meaning, which relies on the researcher. As the position of the researcher is not clearly separated from the setting he/she researches on, qualitative methods have been associated with subjectivity. However, one should not confuse qualitative with subjectivity, and quantitative with objectivity.

Each method has its own strengths and weaknesses. The qualitative method can be criticised for being less scientific, unrepresentative, and open to bias and, even to manipulation, whether conscious or unconscious,[48] whereas the quantitative method can be criticised for oversimplifying and being less capable in explaining abstract terms like fascination, justice, peace, and so on. Hammersley argued that rather than being derived from philosophical or methodological commitment, the choice of method should be based on the goals and circumstances of the research being pursued.[49] In other words, it is the nature of the research problem that should dictate the appropriate research method; accordingly, sometimes quantification is required, sometimes it is not.

It is also possible to employ the two methods side-by-side in the same research project. Hammersley and Bryman offered a continuum of choices when combining both quantitative and qualitative under one research approach, among them are triangulation, facilitation and combination[50] First, triangulation of both approaches, and emphasis on the mutual assessment of results, and less on the mutual extension of knowledge potential. Second, facilitation that highlights the supportive function of the other approach, providing hypotheses and inspiration for pursuing analyses of the single approach. Third, the combination of both approaches as complementary research strategies. Regardless of how the two research methods will be combined, it is necessary to spell out explicitly the theory, methodology, research practice and interpretation of findings.

1.9.2 Research Philosophy

Positivism originally came from the natural sciences, which assumed that only knowledge of phenomena confirmed by the senses could be warranted as knowledge (phenomenalism). Theories are used to generate hypotheses that can be tested and allow explanations of laws to be assessed (deductivism). Knowledge can be produced by collecting facts that provide the basis for laws (inductivism). Science must and can be conducted in a way that is value-free and objective,[51] with emphasis on highly structured methodology to facilitate replication, [52] and quantifiable observations that lend themselves to statistical analysis.

Positivism was criticised by interpretivist, who argued that the world is too complex to be generalised into definite laws in the same way as the physical sciences. There is a necessity to discover the details of the situation to understand the reality or perhaps a reality working behind them (Constructivism). For them, generalisability is not of crucial importance, as the value of generalisation can be lost in a changing world. Generalisation also neglects the fact that the world is unique, thus trying to generalise it may cost the value of the generalisation itself.

Realism is based on the belief that a reality exists that is independent of human thoughts and beliefs. It recognised the importance of understanding people's socially constructed interpretations and meanings, or subjective reality, within the context of seeking to understand broader social forces, structures or processes that influence, and perhaps constrain, the nature of people's view and behaviours.

1.9.3 Research Approaches

Silbergh [53] explained that two main epistemological frameworks have driven scientific inquiry, being the deductive and inductive approaches. The deductive approach uses theory as the starting point for research: it progresses from a theoretical position initially adopted and proceeds to analyse the empirical setting to test the theory. On the other end of the spectrum, the inductive approach uses the empirical setting as its starting point for research: it progresses from the inquiry of the empirical setting, in which a problem is found, and attempts to find a pattern and construct generalisation to finally come to the creation of a theoretical explanation (or not). The deductive approach is used for testing a theoretical preposition, whereas the inductive approach can be used to generate a new theory.

1.9.4 Research Strategies

It is useful to explain different kinds of research strategies in the simplest way possible, but at the same time capturing the core of the strategy, in what kind of setting it is usually applied, and the strengths as well as the weaknesses of the strategy.

Experiment is commonly used in natural sciences. The strategy subjects samples to different experimental conditions, introducing planned changes to one or more of the variables, measuring a small number of the variables and controlling other variables. In the social sciences, experiments are frequently used in psychological studies.

Survey is commonly used in the deductive approach. A survey allows a massive quantity of data to be collected and standardised to produce a comparison, thus providing a 'bird's eye view'. [54] It can be carried out through questionnaire, structured observation and structured interviews. A survey complements qualitative studies in two ways: it can help to frame questions or identify cases for in-depth study; it can also provide context for confirming the findings of qualitative work.[55]The strength of this approach lies in its ability to collect a large amount of data from a sizeable population in a highly economical way, whereas its weakness lies in the limited width and depth of the collected data. For example, putting too many questions in a questionnaire would run the risk of discouraging respondents from participating.

Case study is commonly used in the inductive approach. It aims to investigate a contemporary phenomenon within its real-life context, when the boundaries between the two are not clearly evident, by using multiple sources of evidence. [56]It can be undertaken through questionnaires, interviews, observation and documentary analysis. A case study is valuable in testing a hypothesis and particularly useful for theory development, especially regarding its potential for achieving high conceptual validity, strong procedures for fostering new hypotheses, as a useful means to closely examine the hypothesised role of causal mechanisms in the context of individual cases, and its capacity for addressing causal complexity. It is not without weaknesses, however. The case study is often criticised as being prone to "selection bias"; that is when some form of the selection process in either the design of the study or the real-world phenomena under investigation, results in findings that contain systematic error.[57]

Grounded theory is a response to the overemphasis of theory testing or falsification as the objective of empirical research, which leaves no room for epistemological explanation or practical guidelines concerning the development of plausible ideas.[58] It is also considered as a "third way" between induction and deduction; a study is not commenced with a defined theoretical framework, instead relationships between data are identified as the basis to develop questions and a hypothesis to test, this way a theory may emerge from the process of data collection analysis.[59] Because the ability to identify themes or issues emerging in collected data (coding) is crucial in grounded theory, it is not a good strategy for the inexperienced researcher. In addition, grounded theory can be very time and resource consuming.

Ethnography is part of the inductive approach commonly used in anthropology and sociology. It aims to interpret the social world the research subjects inhabit and the way in which they interpret it. The most common approach is through participant observation, in which the researcher becomes immersed in the culture as an active participant, recording extensive amounts of notes, complemented by interviews, questionnaires and so on. A major criticism of this strategy is that the effect of the researcher's presence on the research subject and the missing important picture that the researcher fails to see could lead to the production of an 'incomplete picture'.

Similar to grounded theory, ethnography is a time-consuming and resource-draining research strategy not to be employed by an inexperienced researcher.

Action research is distinctive from other kinds of research strategies because of its orientation and purpose. Action research does not stop at applied research, but seeks to democratise the conduct of research (design, implementation strategies, evaluation) by engaging stakeholders that traditionally are excluded from the process. The ultimate objective is to understand various social problems and seek the best responses to address them. Action research is normally undertaken through different spirals of steps, each of which consists of a circle of planning, an action/intervention, and evaluation of the action. Subsequent circles work to revise the action using feedback from the previous circle and taking into account unforeseen changes, to devise a better intervention plan. One of the best examples of research action is Paulo Freire's Participatory Action Research, which has helped many international researchers shape their programme to help underprivileged communities.[60]

1.9.5 Time Horizons

According to Saunders, the cross sectional approach is akin to a 'snapshot' taken at a particular time, and longitudinal approach is akin to a 'diary' that represents events over a given period.[61] The distinction between cross-sectional and longitudinal study is based on the number of empirical contacts within the field.[62] In a cross-sectional study, comparison of a number of cases are mostly made on one occasion, whereas the longitudinal study returns to the field twice or more often to do the same data collection again in order to cover development and changes in the field and in the issue under study.[63] Longitudinal research can be undertaken in different ways, such as taking a retrospective perspective, looking back on a development or process in a narrative or biographical study or ethnographic study with a prolonged participation in the field. Longitudinal study can also be introduced into a literature study, provided there is sufficient amount of published data collection over time. Obviously, longitudinal research demands more time and cost allocation than cross-sectional research, which can be impractical for university students conducting research under time and resource constraints. However, it offers the benefit of more control over variables under study and enabling researchers to study change and development.

1.9.6 Data Collection Methods

Sampling can be defined simply as a selection of representative cases from the whole population. There are various methods of sampling, but they can be divided under two broad categories: probability and non-probability sampling (purposive). Probability sampling means the cases are selected by using probability theory, and this can be random or systematic (determining the 'nth' case). Probability sampling requires a researcher to possess a list of all cases in a total population. Different to probability sampling, cases in non-probability sampling are chosen based on reasoning, not mathematical probability. This can be done through several approaches, such as quota, convenience, theoretical and snowball sampling. The most common issue that arises from sampling is how big the sample should be. While quantitative research usually needs more sampling than qualitative research, it has been suggested that for interviews following ethnography and grounded theory studies, a number between 30 and 50 should be sufficient.[64]

Table 1.1 Approaches in Non-Probability Sampling

Quota	Population is divided into relevant categories, and quotas are allocated to every type of respondent
Convenience	Selection of cases on the basis of availability, useful when researching hard-to-access population. Danger of selection bias.
Theoretical	Selection of cases on the basis of the researcher's judgement. Usually employed in grounded theory and analytical induction.
Snowball	Selection of cases on the basis of information given by a 'gatekeeper'. Usually employed in situations whereby the researcher does not have a sample frame of an access-stricken population.

Source: Bloor, M. and Wood, F. (2006). *Keywords in Qualitative Methods: a Vocabulary of the Research Concept*.London: Sage.

Secondary datais where quantitative and qualitative data that have been collected for a purpose are re-used by other than the first user. Secondary data comprise many types: documentary (written and unwritten materials), multiple source (area-based and time-series based) and survey (censuses, continuous and regular surveys and *ad hoc* surveys). Using secondary data means economy of effort; that is, the researcher does not have to start from scratch to collect all data required for research. However, the researcher needs to be cautious in re-using secondary data as such data were organised, analysed and measured according to the first user's goal, and this does not necessary translate to reliability and validity.

Observation in natural science is about collecting information through minimal or nil interaction with the subject of research, and therefore the influences that arise from the presence of the researcher on the data can be minimised. In social sciences, observation is much more than that. Basically there are two kinds of observation: participant observation and structured observation. In participant observation, the researcher immerses into and becomes part of the research setting through several roles such as a complete participant, complete observer, observer as participant and participant as observer. The latter two roles are less problematic in terms of research ethics, because the researcher will have to reveal his or her purpose. Structured observation refers to a structured and systematic way of doing observations. This, however, will limit the data to be taken because it needs to refer to pre-determined indicators and can be more time-consuming.

Interview is about collecting information through questioning of the respondents. It is employed in both quantitative and qualitative research, with different characteristics. Quantitative research employs a 'structured' type of interview using semi-formal approach and a standardised schedule, whereas qualitative research employs a more laid back 'semi-structured' type of interview, which allows room for altering the course of the interview should important key terms arise during the interview.

Questionnaire is using a set of questions with respondents to obtain a set of data. It can be administered by the researcher him/herself (interviewer-administered) or by the respondent (self-administered). Questionnaires are flexible, and can be administered through various communication means such as telephone, email, on-line, postal, delivery and collection as well as through a structured interview, requiring the presence of both interviewer and respondents. The design of a questionnaire has a causal relationship with the degree of validity and reliability of the data, as does the appropriateness of the respondent's familiarity with the research issue (which includes the size of the sample, characteristics of the respondent, types and numbers of questions). A questionnaire is not suitable for exploratory research, but can help to interpret the data because it is gathered in a standardised way.

1.9.7 Research Design

Research design is defined as a:

> "Plan for collecting and analysing evidence that will make it possible for the investigator to answer whatever questions he or she has posed. The design of an investigation touches almost all aspects of the research, from the minute details of data collection to the selection of the techniques of data analysis".65

There is a difference between research design in quantitative and qualitative research. If the first is usually elaborated prior to research plan, the latter is more of a process that runs through the whole length of a project. It begins as a description of the researcher's original view of the problem, theoretical and methodological commitments, and the way these affect the research and are affected by it as the research proceeds.[66] A good research design will contain a purpose, conceptual context, methods and validity, all of which connect to the research question. The research design of this study is illustrated below (Figure 1.3).

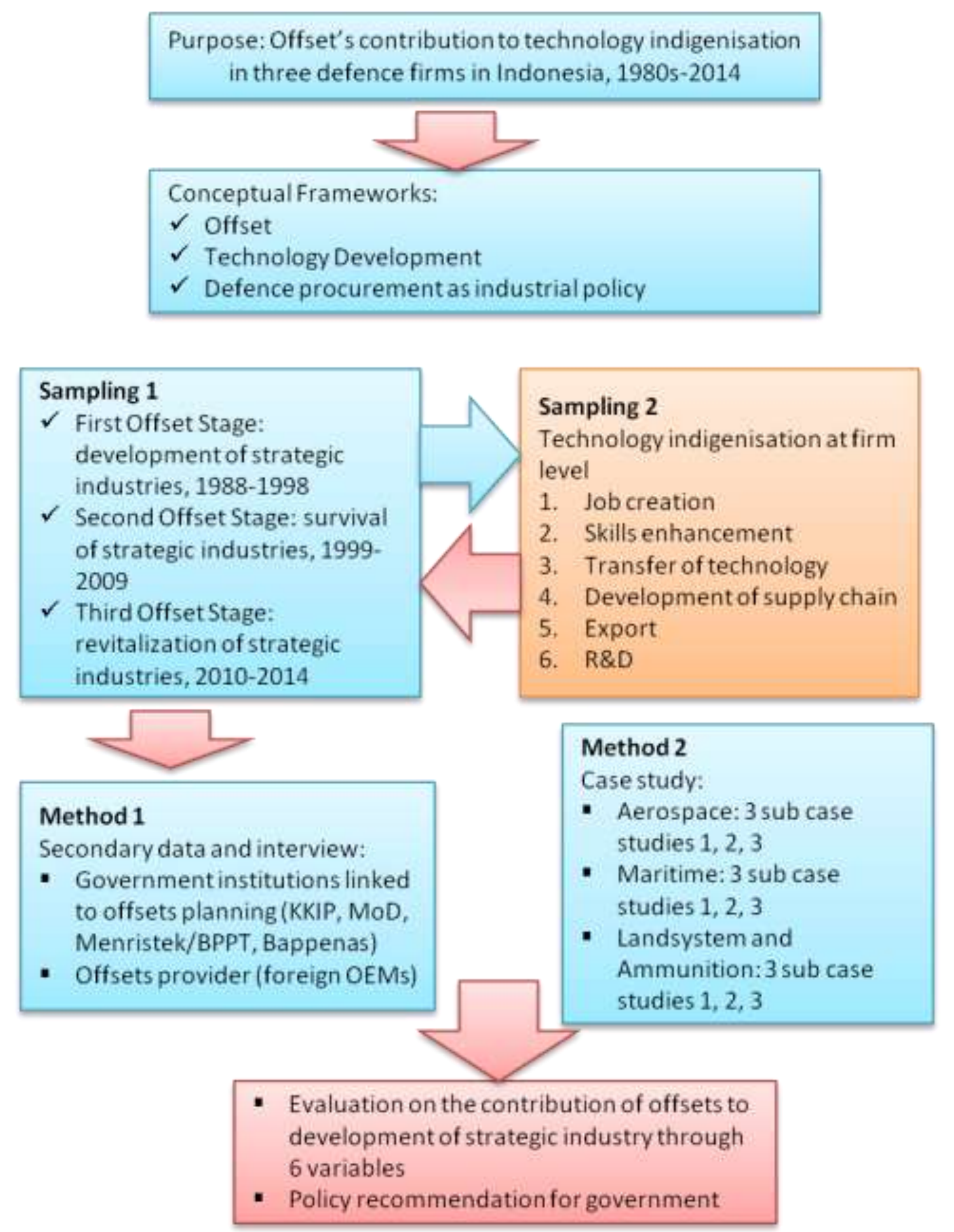
1.9.8 Triangulation

Because both quantitative and qualitative data will be required, a combination of research strategies and methods is necessary. Triangulation is defined as

> "mixing of data or methods so that diverse viewpoints or standpoints cast light upon a topic... to help in validating ..." 67

In this research, triangulation is used primarily to ensure that as much data can be gathered to complement the lack of data when only one method is used. Three methods and strategies will be used in this research: secondary data, survey, and case study.

Figure 1.3 Research Design



Source: Author

Type of Data

There are two kinds of data needed for the study: primary and secondary. Secondary literature - documents, statistics, policy documents - can be obtained from national archives, government websites, industry websites, and so on. Primary data were collected through a survey, in the form of questionnaires, interviews and case studies. Group discussion will also be used to discuss and find the deeper meaning behind questionnaire data.

Time Horizon

In terms of time horizon, a longitudinal study was employed as it was not sufficient to study different periodisation by using cross-sectional approach. The reason for this was the need to capture the dynamics of offset implementation during 1986-2014, spanning across the three periods when the strategic industries were in a state of development (1988-1998), survival (1999-2009), and revitalisation (2010-2014). Hereafter, these periods have been termed Stage One, Stage Two and Stage Three, respectively, as shown in Table 1.2. below.

Table 1.2 Principal Case Studies with Selected Sub Case Studies

Period	Sub Case Study		
	Aerospace	Shipbuilding	Land systems
First Offset Stage	F-16 fighter jet programme	FPB 57 Fast Patrol Boat (FPB) programme	Scorpion light tank programme
Second Offset Stage	KT-1 Wong Bee trainer aircraft programme	Landing Platform Dock (LPD) programme	Tarantula IFV programme
Third Offset Stage	N295 transport aircraft programme	Guided missile destroyer escort (PKR) programme	Caesar howitzer 155 and Mistral

Source: Fieldwork research at PT DI, PT Pindad, PT Pal, April 2014-August 2015

Embedded Case Study Design

The case study approach was conducted in each of three principal strategic industries. The purpose is to achieve a level of validation that cannot be obtained through a general survey. This study addressed offset implementation across three sectors of Indonesian defence industry, comprising aerospace (Indonesian Aerospace, PT DI), maritime (PT Pal), and land systems/ammunition (PT Pindad). The three case study firms represent the sectoral lead integrator of arms production and biggest contributor to defence procurement. PT DI represents 100% of the aerospace sector, and while PT Pal and PT Pindad possess lower sectoral shares, they do represent the biggest company in each of their respective defence sectors. Due to their status as state-owned 'strategic industries' they have also been prioritised as the major receivers of offset programmes.

This research employed an embedded case study design; meaning that within a single case, attention is given to subunits (sub case studies). For example, for the case study of aerospace, attention is given to three different offset programmes across three different stages of offset development. Subunits were selected on the basis of their representativeness in each offset development period and the availability of near-complete data.

Stage Sampling of Offset Development and the Selection of Sub Case Studies

Sampling is necessary as a means of choosing the appropriate case, group and material in a way that the study can be conducted within the resources constraint. This study used purposive sampling, through a combination of quota and snowball sampling. The first sampling frame for analysis related to the population of government institutions which were or are linked to offset policy-making and practice, these are the Agency for Strategic Industry Management (BPIS), as the former lead agency and the Committee for Defence Industry Policy (KKIP), as the current lead agency. The implementation of offset through procurement is conducted by the Directorate of Defence Technology and Industry (Direktorat Tekinhan, DIT TEKINHAN) under the Directorate General of Defence Potential (Direktorat Jendral Potensi Pertahanan, DITJEN POTHAN) and the Defence Facilities Agency (Badan Sarana dan Prasarana Pertahanan, BARANAHAN) at the Ministry of Defence (Kementerian Pertahanan, KEMHAN). Defence industrialisation is closely related to technology policy, which falls under the authority of the Ministry for Research and Technology/ Agency for the Assessment and Application of Technology (*Badan Pengkajian dan Penerapan Teknologi,*BPPT), and development policy is formulated by the National Development Planning Body (*Badan Perencanaan Pembangunan Nasional*, BAPPENAS). The implementation of offset binds two stakeholders: national defence industry and foreign OEMs (Original Equipment Manufacturers) as the offset provider.

The second sampling level was aimed at targeting people in the strategic industries. The sampling must be treated differently in accordance with each offset development stage. While it was difficult to trace the heads of programmes in offset stage one, with some of these programmes having been conducted 30 years ago, sufficient amounts of information were generated by mixing interviews with people involved in the programme with secondary sources. Sampling for offset stage two and three were mostly aimed at the heads of the offset programmes (LPD, KT Wong Bee, Tarantula, N-295, PKR), and those with sufficient involvement in the programmes. 'Sufficient' in this context means that the respondent was directly involved in the programme carrying considerable responsibility; for instance, in contracting, designing and supervising the offset programme.

The way the researcher approached the sampling was through her role as a government consultant at BAPPENAS and KEMHAN. During her work as a consultant, the researcher was involved in a number of seminal researches, such as the profiling of the defence industry (2011-2012), an assessment of defence acquisition (2012), offset policy formulation (2013), as well as defence industry mapping and assessment (2014). Through these projects the researcher acquired access to the primary data sources and access to primary and secondary data (in the form of government reports).[68]

Data Collection

Triangulation was employed to overcome the potential of bias. For this purpose, the research used multiple sources of evidence - comprising primary (survey and interview) and secondary sources (unpublished government reports, company profiles, reputable databases of newspapers like factiva and lexisnexis) - and multiple types of data collecting methods. The survey and interviews were conducted over three time-periods. The first preliminary survey throughout December 2011- January 2012 yielded insignificant results, the fact that only one of the three firms surveyed understood the offset surveys and the other two could not answer the questions rendered the questionnaire invalid.[69] Following a two-year stopgap[70], the second and third surveys and interviews were conducted in mid-2014 (April-June) and early to mid-2015 (January-August).

Table 1.3 Data Collection Activities

	Objective	Target	Timeframe
Preliminary survey	To compile the population of the offset case study and industry's perception on offset	Sampling 2 (PT DI, PT Pal, PT Pindad)	December 2011-January 2012
Survey I	To gain insight intothe understandingof leadership of the three companies on offset as a concept, government policy related to offset, offset life cycle, and the impact of offset to the companies in the past	Sampling 2 (PT DI, PT Pal, PT Pindad)	April-May 2013
Interviews	To generate data on offset policy and implementation through different stages of offset development	Sampling 1 (BPIS, Bappenas, BPPT, MoD, KKIP, BPPT)	April 2014–June 2014
Survey II	To evaluate the impact of offset on aerospace, maritime, and ammunition and land systems	Sampling 2 (PT DI, PT Pal, PT Pindad)	April 2014-August 2015

Source: Author

While the first and the second data collections were targeted at the leadership level of companies, the interviews were targeted at project manager level and the staff directly involved in the offset programme. Respondents were selected through non purposive and snowball sampling, in which a 'gatekeeper' was identified and employed in each respective company. [71] The presence of the gatekeeper was crucial in identifying respondents with suitable experience of offset, some of which are former senior staff that have already left the company.

1.9.9 Data Analysis

There are two important considerations in data analysis: validity and reliability. Validity concerns whether the findings are really about what they appear to be about. According to Robson, there are factors that can undermine the validity of a research: history, testing, instrumentation, mortality, maturation and ambiguity about causal direction.[72] Ensuring validity of research means that the data collection should be held at the most neutral time and condition to minimise bias. Reliability can be measured by testing whether the same result will be achieved if similar research were to be undertaken by other researchers, on other occasions. The key to maintaining research reliability is minimising subject and observer error and bias.

The use of triangulation in data collection is arguably among the most important steps taken to ensure validity and reliability of the research findings. Longitudinal approach also ensured that the conditions when data collections have been conducted are varied. Although the choice of sampling was initially supplied by the gatekeeper, it was not solely limited to the recommendations of gatekeeper. Some of the key respondents have been identified through literature review - specifically news on offset - and, in some cases, names were found coincidentally during the time the researcher worked with the government and defence industry.

Data were gathered and stored using a word processor and excel, to be coded and analysed in two ways: cross cutting three periods within one case study and cross cutting three subcase studies. This ensured that the findings do not carry bias of one sector only, or one offset stage only. The research did not aim for generalisation only, but also identification of the variations across industry sectors and offset periods for the purpose of generating 'lessons learned'. This was in line with the significance of the study, as discussed in the previous sections.

1.9.10 Ethical Considerations

Research ethics concerns the responsibility to carry out research in way that minimises potential harm to people who will be implicated by the research; this includes vulnerable research subjects (from violation that might cause harm both physically and psychologically), the researcher her/himself and the institution where she/he belongs (from law suit and tainted reputation). To ensure the highest standard of ethics will be upheld, the researcher and her/his principal investigator need to be aware of several issues, including competency, consent of the research subject, protection of a participant's welfare, confidentiality and balancing obligation. Competence means the researcher must exhibit knowledge of research methods or have received proper research training. Protection means the researcher must acknowledge the interests and rights of the participant (voluntary participation). Confidentiality means the researcher keeps confidential any information generated from professional interaction with the participant. Balancing obligations means the researcher must be aware of his/her obligation to society, funder/employers, colleagues and the subject of the research, and be able to manage conflicts of interest in a way that would not harm the research subject and institution/profession which he/she represents.

To uphold the highest possible degree of research ethics, the study have taken several precautions, as follows:

(1) In undertaking field research, the researcher has always introduced herself and institution she represented and explained the purpose of research without any deception whatsoever.

(2) Considering defence procurement is a sensitive issue, there might be instances in which research subjects refuse to be interviewed, or withdraw participation after giving an interview. For this purpose, the researcher has briefed the subject on her/his right to terminate participation at any given time, that she/he will have to give consent prior to any participation, have the right for anonymity if necessary, and have the right to check the researcher's notes after the interview has concluded.

(3) The researcher ensured the safety and storage of interview records, to be used solely by the researcher and not to be disseminated without approval.

1.10 Study Structure

The structure of this study is organised around six chapters. Chapter one contains the nuts and bolts of the introduction into the what, why and how aspects of the study. Chapter two will scrutinise the literature on development, industrialisation and technology development though strategic industry and technology indigenisation through offsets. Chapter three will undertake a broad sweep across the conceptual and empirical aspects of offset. The why, what, and how aspects of offset will be discussed, with a focus on the discrepancy between strategic objectives and the complexity of implementation. The thrust of this chapter is to evaluate how offset is implemented, emphasising the shortcomings of methodology, and the limited number of proper case studies of offset evaluation to provide justification for the 'matrix' of offset evaluation. Chapter four will explore the two opposite mainstreams of the Indonesian economic schools of thought, which are *Habibienomics* and *Wijojonomics* that influence the development and technological planning in Indonesia. A major portion of this chapter will be dedicated to Habibienomics, which basically represents economic nationalism, a sentiment that has always been at the forefront of intellectual debate, due to insecurity fears brought about by foreign intervention. Habibie's concept of catch-up industrialisation through 'strategic industries' and technology development through a 'progressive manufacturing plan' represent the encapsulation of Indonesia's spirit of self-sufficiency in the globalised world. The chapter will also discuss the flexibility of Habibie's strategy that became the pretext for defence offset. Chapter five will discuss the three different periods in which offset was implemented in Indonesia: the development of strategic industries (1988-1998), survival (1999-2009) and revitalisation of defence Industries (2010-2014). The imperative behind this stage approach is the 'gap' in offset implementation, created by the economic crisis of late 1990s. The crisis effectively halted the defence industrialisation process through termination of government subsidies and the introduction of a competitive procurement policy. Each of the periods will explore three subcase studies of offset programmes representing each defence industry - PT DI/IPTN, PT PAL, PT Pindad - and assess how offsets have been implemented. The contribution of offset will be evaluated through six variables: job creation; skill enhancement; transfer of technology; creation of supply chains; promotion of export; and R&D. Chapter six will offer conclusions, based on the key findings, and also recommendation for future policy and further research.

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[68] The researcher has introduced her self from the beginning of her works and informed about the research she is working at, that is offset. For utilisation of data from Bappenas study, the researcher has been granted permission to treat the result of study as secondary source. A written permit in form of email correspondence have also been obtained from officer in charge with offset policy formulation at KEMHAN in 2011.

[69] During the first field research in 2011, two out of three firms did not understand the concept of offset and believed they have never experienced such. One of the firm claimed that participation of domestic industry in the procurement of arms form abroad is based on business-to-business commercial consideration, not government intervention. Another firm chose to abort export of arms when facing offset demand from the buyer country, fearing of losing what they claimed to be "only slight margin of profit". Discussion with defence industries, Bandung, May 2013.

[70] The stopgap here was created by the researcher's involvement in the formulation of offset policy, especially throughout 2013. Under this programme the researcher was also tasked with socialisation of offset concept with defence industries. As consequence of this socialisation, the researcher found better understanding of offset had been shared among defence firms.

[71] The gatekeeper in PT DI is the vice president of restructuring; gatekeeper in PT Pal is director of technology; and gatekeeper in PT Pindad is the head of public relations.

[72] Saunders, M., Lewis, P., and Thornhill, A. (2003) *Op.Cit*p.102

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2. FROM DEVELOPMENT… TO DEFENCE 'AND' DEVELOPMENT

2.1 Introduction

The purpose and structure of this chapter is to locate offset within the academic literature on economic development. In order to do so, there is need to undertake a broad sweep across the interrelated literature from development, industrialisation, technology-development and transfer mechanisms, to 'strategic industrialisation'. There is a risk of trading-off in-depth studies and brushing the surface of a handful of seminal works. Arguably, this trade off is necessary to provide an adequate background to argue that offset - a highly specialised topic located under the intellectual umbrella of defence economics - is actually related to the study of a developing economy. The challenge here is to draw a clear connection between the principal components of scholarship to put the debate in a logical sequence as the basis for launching the ultimate argument that defence offset should not be seen as irregular transaction in defence procurement, but rather as a strategy used by developing countries for development.

The opening section of this chapter will evaluate various influential development strategies crafted over the last 50 years. Development is different from economic growth; the latter is defined as an increase in total output that occurs either because the inputs of the factors of production (land, labour, capital) increase or because equivalent quantities of the inputs are being used more efficiently.[1] Development is rather the qualitative aspect of growth, examining the economic, industrial and technological nature of wealth-creation that takes countries to a higher stage of development. Stage theory from Rostow is used to explain economic 'take-off', a condition that leads to self-sustained growth. The balanced vs unbalanced growth debate is used to explain two opposite strategies - 'big push' and 'lead sector' - in kick-starting industrialisation and escaping from the vicious cycle of poverty. Industrialisation is believed to be the key concept for growth; it is measured by the presence of plants involved in manufacturing capital goods as well as processing raw material into finished goods. Technology has been widely accepted as having an imperative role in fostering industrialisation in developing countries, helping diversification of the economy to move-up the ladder of production.

The second part of the study will critically review how technology is understood, through discussion of the process of technology invention, innovation, and diffusion. This part will start with discussion on the need for developing countries to catch-up and break free from dependency on advanced countries. Technology itself is a contextual concept; therefore, adopting foreign technology implies the need for adjusting the transferee's local conditions with that of the transferor. Various transfer mechanisms will be discussed, such as Foreign Direct Investment and offset, to understand the strengths and weaknesses of every conduit appropriate in the context of developing countries, in general, and Indonesia, in particular. As technology transfer is not free, the barriers to technology access and the costs of technology transfer will also be discussed to complete the mosaic.

The third part of the study will discuss the various strategies to technology development, including the Western, Soviet, East Asian and Africa models. The importance of examining the major features of each model - comprising the transformation process, defining characteristics and development goals - is to obtain a grasp of 'circumstantial technological sensitivity'. Technology diffusion, internationally as well as regionally, will be assessed to understand how technology transfer occurs across firms and across countries/regions.

The last part of the chapter will discuss technology development in the context of latecomers, carrying two options: to make, or to buy. The imperfection of the technology market calls for government involvement, which is conducted through procurement policy of advanced technology - one of which is military technology. Developing countries with rudimentary defence industrial capability are torn between make and buy choices. Globalisation achieves cost efficiency but at the cost of greater dependency on foreign technology; while autarky implies independence, but at the cost of economic viability. Either way, arms procurement carries an opportunity cost.

2.2 The Purpose of Offset: Industrial and Technological Development

Development has been the preoccupation of every country, yet it remains largely an unsolved puzzle. There have been many attempts to define and measure development. In a broader sense, development is a normative concept, which implies economic, social, political and cultural transformation that should not be seen as the end but a means to enhance social well-being and quality of human life.[2] Since quality of life is inseparable from human needs and values - which could be perceived differently from one society to another - measuring development has been a challenge. At first, development was seen as synonymous with growth[3]; in practice, this would be GNP (Gross National Product) or GNI (Gross National Income). This approach was soon criticised because defining development as growth has its limits. First, an increase in GNP per capita does not necessarily mean that the quality of life of a country's population is improving, unless there is equality in the distribution of wealth.[4] Second, GNP growth can have either positive or negative benefits.[5]

A more humanistic approach to measuring development was proposed by the United Nations Development Programme (UNDP) in the form of a Human Development Index (HDI) and Gender Sensitive Development Index (GSDI) (UNDP, no year).[6] However, despite its limitations, growth is still seen as the main metric of development. The World Bank, for instance, categorises a country's development based on economic growth measured in GNI per capita - previously referred to as GNP.[7]This results in the categorisation of low (USD1,005 or less), lower-middle (USD1,006-3,975), upper-middle (USD3,976-12,275) and high-income groups (USD12,276 or more). The low and middle-income groups are sometimes referred to as developing countries. Indonesia falls under the category of a lower-middle income economy together with India, Sudan, and Kosovo.

It was, and still is, believed that development would address the backwardness problem of LDCs. The World Bank believed that the estimated growth (1965-1984) for low income countries was 2.8 percent, compared to 2.4 percent of the more developed Western countries; hence, if it can be sustained in the long term, growth would enable the LDCs to 'close the gap' with developed countries. However, after four decades of development, not only could the LDCs not catch-up with the DCs, but they also fell into deeper problems associated with wealth distribution and inequality, landlessness, urban bias, unemployment, underemployment, natural disaster, health, hunger, population growth, deprivation, inequality, and so on.[8] In 2001, the UNDP found that while many countries in Latin America and East Asia have moved beyond the basic threshold of HDI and GSDI, South Africa and sub-Saharan Africa are still trapped at low levels of development. [9] Some countries have made significant progress since kick-starting development, some have not. Questions remain: how to break free from the vicious cycle of poverty and how to achieve not only development but also sustainable development, enabling the LDCs to catch-up with the DCs?

Numerous theories have tried to explain what generates growth and how. Brue (1999) examined six divergent analyses of economic growth and development.[10] The first is the simple yet powerful Harrod-Domar equation (1948, 1957), which postulates that economies must save and invest a certain proportion of their GNP in order to grow: the more they save, the faster they grow.[11] The second is Solow's growth theory (1956), which found that increases in labour and capital inputs only explain less than half of economic growth; the 'residual' being technological progress.[12] The third is Schumpeter (1911, 1954) who argues that the key process in economic change is the introduction of innovations and the central innovator is the entrepreneur.[13] He further argues that innovations do not occur continuously, but rather occur via industrial clusters. The fourth growth theory is postulated by Nurkse (1952, 1959) who argues for balanced development for poor countries to break away from the vicious cycle of poverty and advance. The fifth is Lewis' theory on economic growth which explains the dual-economy phenomenon in developing countries; a division of the economy into two sectors, traditional rural subsistence sector and modern urban industrial sector. Lewis devises the labour supply theory of rural-urban migration theory (1955) rationalising the importance of a dual economy because the agricultural sector serves as a labour reserve for the industrial sector, whereas the industrial sector is capable of expanding due to the hidden-capital reserve until the labour surplus in the agricultural sector is used up. This helps to explain how expansion of national output and income happens in developing countries and creates 'self-sustained' growth and development. The last theory came from Schultz (1961) who emphasises the importance of human capital.

According to Todaro (1989), labour and capital accumulations are both important inputs for development growth, but focusing on them would not be sufficient. He defers to Solow, Schumpeter and Schultz who emphasise the importance of a third input: technological progress. He concludes that investment improves the quality of existing physical and human resources, increases the quantity of these same productive resources, and raises the productivity of all resources. Invention, innovation and technological progress have been, and will continue to be, primary factors in stimulating economic growth in any society.[14]

2.2.1 Adam Smith - The Liberalisation Guru

The father of the modern economy, Adam Smith, published his famous treatise (*An Inquiry to the Nature and Causes of the) Wealth of Nations* in 1776, the same year that America proclaimed Independence, but before the industrial revolution occurred in Great Britain. Smith's book can be seen as a testament of freedom in the economic realm. Smith promotes the idea of *laissez-faire*, free trade, and minimal government intervention, all of which have become the tenets of economic liberalism. He also introduces the concept of specialisation and competitiveness that he believed to be the main features of the (international) division of labour.

To promote economic growth, Smith (1776) believes in economic freedom rather than systematic intervention. The role of government/sovereign is only required for eliminating monopolies and preserving competition.[15] He emphasises rationality of humanand a self-regulatory market, which through the presence of 'invisible hand' economics will work automatically to correct market distortions. He encourages free trade and elimination of trade barriers, based on the theory of division of labour (which later was extended into an international division of labour)[16]. Smith sees trade as a positive sum game: every state will take profits from international trade because each has a distinctive competitiveness – dubbed as 'absolute advantage'. It is derived from natural endowments that others would find difficult to challenge. Competition will force each player to focus on activities (s)he each do best. In reality, the market is not perfect primarily because not all players can access information needed to 'fix' distortions and humans are not always rational.

2.2.2 Rostow's "Take-off" Strategy

In 1960, W.W. Rostow, an American economic historian, published *The Stages of Economic Growth: A Non-communist Manifesto* that celebrated the idea of linear development stages. The fact that his book title openly opposed the Communist Manifesto proposed by Marx is perhaps linked to the geopolitics setting of the Cold War. In similarity to Marx, Rostow (1960) believes that development is a linear historical process. Rostow's development stages are different from those his predecessors offered; they consist of five stages: *traditional society, pre-condition, take-off, drive to maturity, and age of high mass consumption*.[17] According to Rostow, take-off is the most important stage because it enables society to progress from a traditional stage to a modern stage with high mass consumption.

The pre-condition stage is characterised by increased transport investment to enlarge the market and production specialisation, the revolution in agriculture, and the expansion of imports. The take-off stage is characterised by a decisive expansion occurring over 20-30 years, which radically transforms a country's economy because barriers to steady growth are finally overcome, forces for making widespread economic progress dominate the society, and growth becomes a normal condition. The drive to maturity is characterised by a period of growth that is regular, expected, and self-sustained. Furthermore, Rostowargues that to enable take-off, it is necessary to get three conditions in place: (1) an increase in productive investment of more than 10% of national income; (2) development of one or more manufacturing sectors with a high rate of growth; (3) the existence or quick emergence of a political, social and institutional framework that will reinforce the moves towards expansion in the modern sector.[18] If Marx emphasises the labour factor in the mobility of development stage, Rostow gives emphasis to capital accumulation, investment and manufacturing through a 'leading sector' approach.

Rostow's precondition to take-off stage, despite being widely acclaimed, suffers from a lack of supporting historical fact. Nevertheless, the term is widely used to describe the necessary conditions for initiating self-sustained growth. Rostow's prerequisite for upward mobility in development stages, which give emphasis to capital accumulation and investment, echoes the Harrod Domar equation, and convinced governments of the importance of capital. In the context of LDCs, this had been translated into massive doses of aid and foreign capital. Rostow's concept of a leading sector also echoes that of his predecessor Hirschmann (1958), who argues the need for a 'leading sector' to set off development.

2.2.3 Balanced v Unbalanced Growth Models

Balanced versus unbalanced growth has been for a long time the most prominent contemporary debate in development strategies. The debate is essentially about how best to initiate a development process. The core of this debate is the 'big push' versus 'lead sector' conundrum. It revolves around the question as to whether investment should be focused on one leading industrial sector or should be spread across all industrial sectors in the economy.

Although the term 'balanced growth' was first advocated by Nurske (1953), the original formula can be traced back to the 'big push theory' advocated by Rosenstein-Rodan (1943). Big push theory is about the simultaneous establishment of some complementary industries (coordinated investment programme), to secure positive *externalities*, and to allow the creation of a domestic market big enough for creating its own, self-propelled effective demand.[19] Externalities are impacts created by individual producers or consumers, whose effects are felt elsewhere in the economy.[20] The argument for a 'big push' rests upon the effort to break the 'vicious circle of poverty', a theorythat argues low productivity, low incomes, and low levels of living are mutually reinforcing phenomena.[21] Nurkse (1953) sees balanced growth as a necessity to create market inducements to invest and achieve greater diversification.[22] In the context of LDCs, diversification is essential to overcome trade barriers to their export in international trade. Scitovsky (1959) highlights the importance of complementarity and the related external economy; that it is imperative to have central co-ordination of investment decisions. Balanced theory implies the need for centrally planned industrialisation with the same rate of growth across all sectors.

Hirschman (1958) criticises balanced growth theory for its unrealistic view. It is lacking in elaboration on how underdeveloped countries can obtain the required administrative capacity to carry out a balanced growth programme and how to get the necessary resources for investment. He argues that LDCs do not have abundant sources of sound government decision making and entrepreneurship, and therefore it is better to concentrate these scarce resources on a few sectors rather than stretching them thinly. In reality, it is very difficult, if not impossible, to achieve the same rate of output from every sector as postulated by balanced growth theory, because some sectors could grow faster than others. Thus, Hirschman proposes an alternative 'unbalanced growth theory'. He suggests that investment be poured into key industries with forward and backward linkages. Backward linkages refer to linkage from a particular industry to its suppliers. This can be measured through an interdependence ratio, the ratio of total purchases value from other branches sales value to total demand value. Forward linkages refer to linkages between industry and its users. Linkages are important because they relate to positive externalities, or benefits to the broader economy.

Mathur (1966) argues that the two different theories are neither opposite nor contradictory; instead, they are mutually reinforcing[23]. He sees balanced-growth as the ultimate objective, whereas unbalanced-growth is the means of achieving it. When comparing the features of the two theories, he found similarities between balanced and unbalanced growth, such as the need for overhead investment, and when it comes to avoiding shortages, the two theories are actually mutually supportive.

2.2.4 Development Through Trade

The impact of trade on developing country's development has been a subject of intense debate between the free trade advocates and the pragmatists. The central argument of trade as the engine of growth is based on the idea of comparative advantage and international division of labour. Neo-classical growth theory argues that foreign trade could be used as an effective 'engine of growth'. History testifies that a large part of economic growth has actually been generated by exports. The core of the trade and development theory argument is comparative cost, which rests on the idea raised by classical economist David Ricardo. His argument about the principle of comparative advantage revolves around the idea of relative cost and price differences: a country will specialise in the export of products that can be produced at the lowest relative cost. This way, even the most imbalanced trade will still be able to generate profit to all participants.

Prebisch (1950, 1959) witnesses the failure of Ricardo's comparative advantage theory when Argentina lost its comparative advantage in the beef and wheat markets due to the Great Depression and growing US economic domination. The prolonged crisis in the Western hemisphere made it difficult for LDCs to import manufactured goods. The fact that the price of primary goods also fell reinforced Prebisch's doubts on comparative advantage theory. Prebisch and Singer (1950) observe that there is an international division of labour between periphery states that produce and export raw materials, and centre states that specialise in the production of manufactured goods. The division puts periphery states at a disadvantage because raw materials are subject to deteriorating terms of trade vis-a-vis industrialised countries, and the gains from trade are accumulated in the centre states.[24] Therefore, Singer suggests that instead of specialising in the export of commodities, the periphery should attempt to change the whole structure of comparative advantage by promoting industrialisation. The Singer-Prebisch thesis was supported by scholars and staffs of the Economic Mission for Latin America (ECLA) - a UN development programme in Latin America that later established what came to be known as dependency theory/structuralism.

Singer and Myrdal question the developmental effect of international trade. Myrdal (1957) agrees that free trade might have a 'spread effect' in the short term, but in the long term he warns of the 'backwash' effect that might lead to underdevelopment. He criticises free trade for the tendency to aggravate the existing gap between DCs and LDCs, because the expansion of market would favour those with developed industries. The Dependency school's conception of industrialisation is commonly represented in the industrialisation strategy of import substituting industrialisation (ISI). Its aim is to achieving independence in manufactured goods by replacing previously imported manufactured goods with local goods.[25]Arguably, because it is almost impossible for newly built local industry to compete with more established industry from core countries, support for local industry is required.

Wallerstein (1979) argues that upward and downward mobility in the international division of labour is made possible. He uses the experience of NICs to propose the idea of a semi-periphery as intermediate countries that shift upwards from the periphery and act as a buffer between the core and the periphery, buying high-tech products from the former and exporting semi-manufactures to them while importing raw material from the periphery.

Contrary to dependency theory, neo-classical growth theory argues that whether a country is weak or strong in international trade is not an imperative, as long as it can optimise its power by concentrating on activities in which it is relatively more powerful. Ultimately, trade will contribute to the diffusion of technology, expanding market opportunities, and encourage upward mobility.[26] The key to benefitting from international trade is minimal government intervention and barriers. Neo-liberalists argue that many problems of development can actually be traced back to misguided government intervention. They also argue that openness did not preclude LDC industrialisation but rather encouraged technological adaptation, learning and entrepreneurial maturation.

2.2.5 'Catch Up' Industrialisation Strategy: The Critical Role of Government Planning

Industrialisation has been seen as the principal hope for LDCs to improve levels of income. Chenery (1960) points out that increases in per capita income are accompanied by industrialisation or increases of industrial output.[27] Industrialisation can be defined as the change in an economy from one that depends primarily on agriculture to one that eventually relies on manufacturing activity. The first industrialisation occurred in eighteenth century Great Britain. Although not immediately ignited, industrialisation was closely related to the invention and application of technology.[28] A decade after the British embarked on industrialisation, other countries followed by adopting and indigenising the technological innovations of British industry. Industrialisation that soon followed in Western Europe and America was termed 'catch-up industrialisation'.

There is neither a common definition for industrialisation nor agreed basic characteristics of the manner in which it manifests itself.[29] Industrialisation is pretty much a regional phenomenon that takes place within Western countries; the characteristics – despite close resemblance – are not materialising at the same pace and level in all industrialising regions. Industrialisation has been measured by the presence of plants involved in manufacturing 'capital' goods as well as the processing of raw material into finished goods. Kuznets sees the expansion of manufacturing's contribution to increasing per capita income as one of the most important indicators of industrialisation.[30] When Sutcliffeintroduces a three-in-one test to measure industrialised country status in the 1960s[31], he finds that only a small number of developing countries could pass this test, aside from their developed counterparts; these included Western Europe, Eastern Europe, North America, Japan, Australasia, Argentina, Hongkong, Malta and Singapore; whereas Israel, Uruguay, Yugoslavia and Portugal were on the borderline.

Manufacturing is seen as the engine for growth in the promotion of industrialisation. Compared to agriculture and the services industry, manufacturing is believed to be more productive and has proven empirical correlation to increases in GNP. Manufacturing also offers special opportunities compared to agriculture, such as capital accumulation, economies of scale, embodied and disembodied technological process, as well as stronger linkage and spill over effects.[32]

According to Chenery and Srinivasan (1989), every developing country attempting industrialisation will face three strategic options: export primary products and import manufactured goods; launch domestic production of manufactured goods that were initially imported (import-substitution industrialisation); and export manufactured goods (export-oriented industrialisation). The choice between Import Substituting Industrialisation and Export Oriented Industrialisation is often contradictory, but in a sense it is analogous to the stages of industrialisation in which the latter cannot occur if the first had not taken place. ISI was famous in the early independence (post World War II) period, whereas EOI began to a rise in the early 1960s notably in East Asia.

ISI became the principal industrialisation strategy of LDCs in the early 1950s. The key concept for ISI is the infant industry argument, dating back to the idea advocated by Alexander Hamilton and Friedrich List in the nineteenth century, and the international trade/division of labour as advocated by the dependency theorists mentioned earlier. According to Prebisch, ISI was meant to halt transfer of the surplus from the periphery to the core country.[33] The main device used for this purpose was restricting importation of manufactured goods in the form of tariffs, quotas and multiple exchange rates to offset the difficulty in the balance of payments.[34]

ISI was adopted predominantly in Latin American and Asian countries, but the latter abandoned the strategy in 1960s. When Sutcliffe surveys industrialisation in LDCs, he finds that some Latin American countries like Argentine and Chile had actually regressed; even though they kick-started industrialisation earlier than other developing countries, they were slow in generating new jobs.[35] ISI is criticised because too much government intervention can create an inefficient allocation of resources. Little, Scitovsky and Scott (1970) list several basic weaknesses as shown in Table 2.1 below.

Table 2.1 Critique of Import Substituting Industrialisation

Intrinsic problems of government interference	Excessive administrative regulations gave rise to bureaucratisation, corruption, uncertainty and delays and thus discouraged productive private initiative
Bias against export	The existence of import restriction led to a higher exchange rate than would have prevailed under a free-trade regime, reducing the relative gains obtained from exporting.
Bias against agriculture	The protection of local industry raised the price of manufactured goods relative to the agricultural product in the home market and the overvalued exchange rate reduced the domestic currency receipts for agricultural export.
Under utilisation of installed capacity	Since import controls did not equally apply to capital goods and since credit for installing machinery was relatively cheap, factories were over equipped. Moreover protection in product markets made it possible to earn good profits even at low capacity utilisation

Under utilisation of labour	Capital goods could be obtained relatively cheaply due to the combined of over-valued exchange rates, low import restrictions for such goods and subsidised financing conditions, resulting in a bias against employment of labour.
Import intensity of ISI	While the importation of consumer goods was reduced substantially, this was achieved at the expense of increased imports of equipment and materials, resulting-contrary to expectations- in an even more rigid dependence on foreign supplies and renewed foreign exchange crisis.
The slowing down of ISI	Although initially industry can grow faster than domestic demand for manufactures, LDCs soon run out of import substitution possibilities. After than growth rates can only be maintained by a growth in domestic demand or in export, but by then the structure and inefficiency of industry stand in the way of conquering export market

Source: Little, S. and Scott (1970). *Industry and Trade in Some Developing Countries*. Oxford University Press and the OECD Development Center.

The other side of industrialisation strategy, EOI (Export-Oriented Industrialisation) has been associated with the emergence of NICs in Asia. Weiss studies the extent to which industrialisation of developing countries has changed the economic structure of these economies, and how uneven industrial development has occurred within groups of developing countries. [36] He measures structural change caused by industrialisation through *manufacturing growth*, change in the *proportion of workforce* engaged in manufacturing or industry, in general, composition of *manufacturingoutput,* and *composition of export*. According to Weiss, since the 1960s the inequality between countries has increased rather than diminished. As a result of this inequality, a new classification had to be introduced to address a new group of rapid industrialising countries, becoming known as the NICs.[37] The different between NICs and LDCs is described in Table 2.2.

The emergence of the NICs in Asia helped to propel a new discourse on alternative development paths for LDCs. Economists, however, did not see the 'Asian miracle' in the same light. The prominent factor responsible for this phenomenon remained in dispute, but the role of EOI was acknowledged, alongside capital accumulation, and technological progress.[38]

Table 2.2 Differing Characteristics between NICs and LDCs

NICs	LDCs
The role of manufacture varies markedly, but the average share of GDP is around 15 percent	Small manufacturing role in the economy
Diversification as well as expansion in manufacturing	Economic growth since 1960s has been below the average for developing countries
Trade pattern: increasing domestic production to substitute import; become main exporters of manufactures from LDC	Manufacturing value-added per capita increase slightly at below 2 percent or under the average growth for developing countries at below 5 percent
Product exported: move to higher value commodities involving great processing of raw materials and more use of capital	

Source: Weiss, J. (1988). *Industry in Developing Countries*. Croom Helm.

Debates on the essential features behind the success of NICs revolved around political, cultural and development strategy. Gereffi proposes three characteristics responsible for the success of NICs: the presence of the developmental state; cultural factors; and an outward-looking development strategy.[39] Quibria (2002) divides explanations behind the Asian miracle into primary and secondary factors. Primary factors exist in all NICs countries whereas secondary factors vary from one country to another. The primary factors are openness, macroeconomic stability, labour market flexibility, and education policy.[40]

The success of NICs reignites discourse on the role of the government/developmental state in development. Previously the dependency theorists advocated strong governmental intervention in ISI strategy, but the approach was heavily criticised by neo-classical theorists that see markets as efficient (free-market analysis) and government cannot do anything right (public-choice theory). The need for selective governmental intervention had been acknowledged by Gerschenkron, who believes that in the context of catch-up industrialisation government intervention – primarily through planning – is essential to ensure that the initial development push occurs.[41] According to Todaro (1989), since market failures are more widespread in LDCs, i.e. investment coordination, incomplete information, externalities in skill creation and learning, and economics of scale, governments have a key role in facilitating the operation of the market through selective interventions, such as investing in physical and social infrastructure, health care facilities, educational institutions as well as providing a suitable climate for private enterprise.[42]

2.3 Technological Development and Transfer Framework

The correlation between technological innovation and the long-term dynamics of national economies was first suggested in the 1930s by Schumpeter, subsequent to Kondratieff who advocates the important role of technological change in shaping long-term cyclical trends in economic development. Historians Cameron and Neal suggest that history is replete with evidence on the major role played by technology in instigating the industrial revolution. The first industrial revolution saw the development of production (the factory), the mass production of textiles, the use of waterpower and access to cheap cotton (from the colonies); the second industrial revolution saw steam power; and the beginning of early 20th century saw electricity and mass production technologies.[43] This century, it is impossible to dispute the tremendous impact of information and communication technology (ICT) on human life: it changes the way people communicate, study, shop, conduct business, and even conduct war.

Technology is simply understood as goods, processes, methods of production, all of which adds value. Understanding of technology can be generated from different contexts, i.e. economic, engineering, social, as well as philosophical. Accordingly, Pelc concludes that technology could have a specifically tailored definition according to the context of disciplines that are neither synonymous nor convergent.[44] Abramovich, Lall (1992), and Nelson and Sampat (2001) emphasise the importance of understanding technology not only in physical but also in social terms. Social technologies are embodied in organisational forms, bodies of law, public policies, codes of good business and administrative practice, customs, expectations and norms.[45] These are preconditions for the effectiveness of operations as well as the transfer of physical technologies.

How technology relates to economic growth has been the focal point of the new growth theory.[46] The theory evolved from criticism on the Solow-Swan growth model: that in the absence of technical progress as a result of diminishing returns, a slowdown in growth will prevail.[47] The model attempts to endogenise technical change through the use of external economies and spill over, and points to human capital (in addition to physical capital) as the determinant factor in economic growth.[48] The theory also examines the mechanism by which technology is transferred from one firm to another, within an industry in a single country and then across national borders. Innovation not only serves the country's technical advances, but also could drive other countries' growth through diffusion.

2.3.1 Autarky and State's Quest for Technology Change and Transfer

The essence of technological change is the upgrading of technology: it means moving from a low-skill task to the production of complex components, making new products of higher value, moving-up the value chain, and eventually producing innovation. Technological change can be generated from indigenous learning or imitation/technology transfer. According to Schumpeter, new technology is first introduced by innovators and eventually imitated by competitors. The function of imitators is to restore perfect competition that had been distorted when the innovators gained excess profits due to their technological advantage. Therefore, technological change is not something static. Gershenkron (1951, 1962), Eaton and Kortum (1999) argue that possession of technology enables an innovative country to leave the others behind.[49]

In the case of latecomers, the available technology stocks in an advanced country could mean the opportunity to kick-away the ladder and avoid recreating the wheels by imitating foreign technology. Geschenkron and Abramovic (1986) suggest that there is actually an advantage associated with being technologically laggard. Abramovicexplained the central idea of catch-up linked to the level of technology embodied in a country's capital stock.[50] A country where technology is invented and applied to industrialisation will have a technological age similar to its chronological age, but a technology recipient country will have a technological age relatively shorter than its chronological age due to the elapse of time needed to enable the transfer. The catch-up hypothesis postulates that the bigger the backlog, the bigger the leap a latecomer country must achieve. The possibility of making this leap will be reduced as follower countries close in on the leader.

The basic problem in technology catch-up is that it is not free and is always a challenging venture. [51] If successful, the latecomers that catch-up with the industrialised developing countries would be able to master innovations that had evolved over more than a century in the West in a much shorter period. NICs serve as a testimony of this process (see Table 2.3. below). All NICs are major customers of technology transfer, channelled primarily through licensed production and FDI.Their catch-up success is proven by the spectacular rates of export growth, especially during the first two periods of development (1961-1970 and 1971-1980). The average economic growth of the NICs during these periods is significantly higher than that of Southeast Asian countries. Taiwan recorded the highest average economic growth in that period. The electronics sector was the driver behind Taiwan's rapid economic growth, which led to a tenfold increase in GDP per capita over the last four decades.[52] South Korea was transformed from a war-torn country to the 15th largest economy in the world. Singapore was ejected from its hinterland Malaysia in early 1960s with no natural endowment but manpower and rules of law; it is now the trading and transportation hub of Southeast Asia.

Another imperative of technology transfer for catch-up is autarky or technological independence to ensure economic growth. This fits with the argument of dependency/structuralism theory, which advocates that technology could help developing countries overcome dependency on manufactured goods from developed countries by producing goods locally (import substitution). One example of the importance of technological independence is China, which was dependent on the import of Soviet capital goods from 1949-1957. When in the late 1950s the two engaged in a war, China was punished by a Soviet embargo. China's economy was seriously affected by the embargo and as consequence it resorted to autarky until 1978.[53]

Table 2.3 Decade Growth Rates for Selected Asian Economies

Economy	1961-1970	1971-1980	1981-1990	1991-2000
China	3.7	5.4	9.3	10.2
Hong Kong	9.9	9.2	6.6	4.4
Korea	8.3	7.8	8.7	6.3
Taiwan	11.3	9.0	8.0	6.4
Indonesia	4.2	7.9	6.3	4.4
Malaysia	6.5	7.9	6.1	7.2
Philippines	4.9	6.0	1.8	2.9
Singapore	10.0	9.1	7.4	7.8
Thailand	8.2	6.9	7.9	4.6
Bangladesh	4.1	1.6	3.9	4.8
India	3.9	3.1	5.9	5.3
Pakistan	7.3	4.6	6.2	4.0
Sri Lanka	4.6	4.6	4.3	5.2
Japan	10.5	4.5	4.0	1.4

Source: Dawling, J. M. and Valenzuela, R. (2004). *Economic Development in Asia*. Cengage Learning Asia.

Technology adoption can also help the periphery countries to migrate vertically to intermediate status as experienced by the NICs. Technology is therefore an imperative factor in upgrading a country's competitiveness in the international trade arena. Take the example of Singapore, which owns substantial oil refinery industries. Singapore imports raw oil from its neighbours and sells refined oil back to them and to other countries. In this context, Singapore's technological advantage allows it to act as intermediate actor between raw material exporter and the buyer.

Supranational institutions like the United Nations have also been urging for more technology transfer to developing countries. For example, the organisation believed diffusion of clean and climate-friendly technology would be the critical factor in both mitigating climate change and embarking on sustainable development in the disaster-prone countries. Seen from this point of view, diffusion of certain technologies can be beneficial for both transferor and transferee countries.

Indeed, research conducted by Easton and Kortum shows that diffusion of technology is actually beneficial for the inventor countries.[54] The research was conducted to measure quantitatively the research effort, growth productivity and the spread of technology across the US, Japan, France, UK and Germany. The authors believe that by eliminating international barriers to technology diffusion would not only bring productivity levels very close together but also would raise productivity.

2.3.2 Conduits of Technology Transfer

In the early stages of development, the NICs like Japan and South Korea attracted and used foreign technology, mostly through license-production. In the case of leading-edge technology where the license was not available, a mission was sent overseas to obtain the technology and imitate it.[55] The NICs invested much on R&D so as to adopt the foreign technology. Southeast Asian countries on the other hand, obtained foreign technology through Foreign Direct Investment (FDI).

Besides license-production and FDI, there are other channels of technology transfer listed in the literature, such as international trade in goods, outward and inward FDI, return migration of scientists and engineers, publication and patents, and so on. Transnational companies undoubtedly have been the prominent player in technology diffusion. They conduct technology transfer through internal and external vehicles. Internal transfer is conducted through FDI and external transfer is through licensing agreements. This paper discussed six conduits of technology transfer that occur with participation of foreign companies: licensed-production, turnkey project, FDI, joint venture, strategic alliances and offset.

A. License-Production

License-production is a commercial agreement to provide the rights of intangible property to the license buyers, enabling them to manufacture part or whole of the licensed technology. In the implementation period, the degree of technology transfer under licensing can vary, from merely assembling knockdown kits to access to patents, inventions, processes, designs, trademarks as well as critical material production. Licensing is expensive and only allowed for a certain period of time or for a number of goods. Some license-production does not allow the licensee to market the product to third parties, without going through a certain level of indigenisation first. Some licensing allows the licensee to market the technology but the royalties will have to be paid back to the licensor.

Licensing has some advantages for the licensor, especially those lacking capital for investing or prevented from investing in the licensee's country.[56] This will save the licensor expensive development and risk costs associated with opening a new market. Whereas the benefit for the licensee is that it allows rapid acquisition of product and process know-how, while preserving local control over adaptation and modification. Adaptation and modification of the technology will be influenced by demand and the market, rather than by the licensor.

Chandra and Kolavalli (2006), through their research on ten cases of technology transfer across Malaysia, Taiwan, India, Chile, Kenya and Uganda, discovered several downsides of licensing.[57] First, it does not encourage local firms to keep up with technological progress and requires a significant level of technological capability in the licensee country or firm to put the licensed technology to work. Usually, it is mature technology that firms seek to license. Due to the time elapse in the transfer, by the time the licensee is finally able to master the technology, it has already become obsolete. Second, it is also unlikely that the best manufacturing technology will be transferred because the licensor does not want to lose competitive advantage. The third limitation of licensing is that the buyer must develop its own marketing capabilities. For the licensor, licensing is risky because there is a possibility that the licensee will violate the licensing agreement. Cross licensing is introduced so that each licensor will also become the licensee, hence making both susceptible to violation of licensing terms and mitigating the risk at the same time.

The United States and Japan are among those countries that used license-production to kick-start technological change. The United States imported the steam engine from the British in the 18th century, but strong local technical capability made it independent from imitating British models and techniques. Japan licensed a great number of foreign technologies in the post World War II era, and was able to assimilate the technology to its own advantage.[58]

B. Turnkey Projects

A turnkey project concerns the export of technology by setting up the entire production system. This means a plant will be designed, constructed and installed by the transferor country or firm in the host country. The term turnkey refers to the fact that only after the plant is fully established, can the transferee firm turn the 'key'to the project to make it operable. Turnkey projects were popular among American firms in the 1990s as their outsourcing increased the share of their manufacturing abroad.[59]

According to Hill, a turnkey project is more common among companies that specialise in complex production technologies, such as petroleum, chemical, pharmaceutical and metal refining companies.[60] A turnkey project has some advantages, and there are also risks associated with it. Hill argued that in countries that restrict FDI, a turnkey project helps them access technology without allowing much FDI inflow. For the transferor, a turkey project allows it to earn greater economic return without having to invest in long-term investment. This is particularly helpful in a country with no stable political and economic environment. However, by selling complex technology, the transferor firm risks losing competitive advantage and creating a potential competitor in the future.

C. Foreign Direct Investment (FDI)

FDI refers to activities carried out by firms seeking to invest directly in production or marketing of a product in a foreign country. According to Hill, there are two kinds of FDI: green-field investment that involves the establishment of a new operation in a foreign country and acquiring or merging with local firm in foreign country. FDI is driven by companies keen to go transnational, becoming part of the globalisation phenomenon.

Developing countries see FDI as a source of external financing besides development aid. FDI also contributes to the transfer of technology, improved labour, and management skills. Most developing countries use FDI to acquire technologies, enabling them to achieve technology mastery but not necessarily deepening.[61] The positive side of FDI is that MNCs may invest in upgrading of local capabilities through R&D, but only for those with a good skills base and scientific and technological infrastructure. The less-endowed countries will be given the results of foreign R&D, not the process. This is reflected by the distribution pattern of FDI, the majority of which goes to advanced countries and not developing economies.[62]

The negative side of FDI is that it can actually conflict with local capability development, if there is no strong government policy to develop local capabilities. FDI also implies technological stagnation at the level of assembly, [63] which can be overcome if a national technological learning system is present.

D. Joint Ventures

A joint venture is a long-term commitment by two or more parties to undertake joint economic activity through the creating of a new entity. These parties contribute funding, facilities, services and share revenues, expenses and the control of the enterprise. Companies have various motives to create joint ventures, such as getting access to new technologies and markets, strengthening a company's market power, exploiting the larger economies of scale and size that joint ventures offer, getting access to new technology, financial resources, customers as well as good managerial practices. The length of joint ventures varies according to either a specific project or a perpetual business relationship. Joint ventures can be created in a specific project or a perpetual business relationship through a number of forms, including corporation and Limited Liability Company.

Through joint venture a firm can benefit from a local partner's knowledge of local conditions, such as culture, political system and competition, share the risk and development costs of opening new markets, as well as the political benefits of having influence over local government policy. The downsides are similar to other conduits of technology transfer: firms entering joint ventures are facing the risk of giving away control over their own technology to a partner firm. Sharing ownership also risks conflict.

E. Strategic Alliances

A strategic alliance is a form of relationship between two or more independent firms to coordinate their resources for a specific business project, without having to merge into or create a new single entity. It is somewhere between conducting the companies' own business and merging their operations. Different from a joint venture, the relationship among parties involved in strategic alliances is that it is non-equity, less formal, and formed through a written contract with a termination period. A strategic alliance can materialise in many forms, like a technology transfer agreement, joint development of product, marketing, and promotional collaboration. The alliance can be for a one-off activity, or to concentrate on one issue in business, or to develop a new product jointly. The basic reason for creating a strategic alliance is to acquire competitive advantage. Even competing firms would create a strategic alliance to gain the benefit it offers. One company can have several strategic alliances with different firms.

In the defence sector, international strategic alliances can be defined as a loose industrial arrangement between defence firms in two or more countries to share information or to study future possible co-production or co-development. An example of a strategic alliance is that between Britain's BAE Systems and France's Dassault on a joint defence study for a future attack aircraft.

F. Offset

Offset is perhaps the most understudied conduit of technology transfer. Part of the reason is perhaps because it takes place mostly in the arms market, which is not as transparent as the commercial market. Offset is a form of compensation in international trade involving high technology, such as military product and aerospace. As the power of buyer countries is strengthened by the oversupply in the international arms market in the post Cold War era, offset transactions and values increased significantly.[64] While offset is initially demanded by buyer country as part of procurement deal, it is now valued as a strategic marketing vehicle for achieving arms exports.[65] License-production and co-production are the two most common technology transfer conduits under offset.

As with other conduits, offset has several strengths and weaknesses. Amongst the strengths are: firstly, securing both political support for military expenditure and economic gains from military procurement compensation; secondly, with the increasing emphasis of dual-use policy, offset may have the benefit of straddling the civil-military divide;[66] thirdly, offset offers similar benefits as other conduits, such as skill enhancement, technology transfer, and economic diversification.

The weaknesses of offset are no different from other conduits of technology transfer. Firstly, offset incurs the costs of technology adaptation. However, due to the high secrecy of defence procurement, the cost is difficult to clarify – and can thus create opportunities for corruption and collusion between the offset transferor and transferee. Secondly, if the recipient countries do not have technology absorptive capability, it is difficult to put technology gained from offset into use. The classic example is India, which has been locked into a succession of license-productions and continuing dependency on Soviet/Russian military technology since the 1960s. India has finally been able to launch a prototype of its indigenous *Tejas* intermediate fighter jet, but critical technologies like engines are still manufactured abroad.

2.3.3 Challenges of Technological Catch-up

Evenson and Wetsphal argue that 'circumstantial sensitivity' - or 'technological congruence' as Abramovitz puts it - is a major constraint on the application of foreign technology. Broadberry provides an example of the adoption of American methods of standardised production that led to the decline of British industry in the post World War II era until 1979,[67] and the American effort to adopt the German professorial system of research management training that failed to take root on American soil[68].

Rosenberg (1970) argues that there is no such thing as a technological solution to the problem of LDCs. He criticises the fact that technology, especially Western, has been exaggerated as the panacea for LDCs. The dilemma of innovation versus adaptation is not without reason. Some technologies are created specifically to local conditions, especially in the agricultural and medical sectors. In addition, factor endowment can also vary from one country to another. In the nineteenth century, for example, Britain was bestowed with abundant human resources but scarcity in land. The US, on the other hand, had abundant land but minimal workers. The difference explains why fertilizer technology is more widespread in Britain, while agricultural machine technology is more prevalent in the US.[69] Making the right choice of technology is linked to the convergence of local conditions with technological development, vital in the adaption of foreign technology.

Central to the dilemma of technology diffusion is the question as to how technology transfer can be undertaken in a context where the gap between the latecomer and the technology leader is immense. Schumpeter suggests that latecomers should seek 'intermediate technology' first before aiming for more complicated technology, because it is simply impossible to adapt state-of-the-art technology if the capability gap between transferor and transferee is too wide.

In addition to the difficulty of transferring technology from one setting to another, it is also costly. The cost of technology transfer comprises four categories: the cost of pre-engineering technological exchange; the engineering cost associated with transferring the process design and the associated process engineering in the case of process innovation, or the product design and production engineering in the case of product innovation; the cost of R&D personnel during all phases of transfer project; cost of pre-start-up training costs and the excess manufacturing.[70]

Arguably, technology transfer has become both easier and yet more complicated. Chandra and Kolavalli argue that it is easier in terms of gaining access to technology, but more difficult because global competition is rising and taking new forms, driven by rapid technology change and the growth of global production networks.[71] Nelson (2005,) lists elements that had existed in all successful catch-up cases, such as inflow of better skilled people, active government support through protection and subsidy, as well as weak Intellectual Property Rights regimes.[72] He warns that these conditions no longer exist in contemporary catch-up countries; for example, subsidy and protection will be met with punitive actions, and so will legal and IPR infringement. Nelson went further to argue that the research capabilities of public institutions will play a vital role in 'catch-up' in the 21st century, because of a combination of factors: the need to develop indigenous technology is increasing as imitating technology becomes more difficult, the need to supply trained engineers and applied scientists for catch-up manufacturing, and the need for strong R&D capabilities to keep-up with the technology frontier.

The role of the state is crucial in setting up technological capability, but it is not the only actor. A state's duty is to lay down the foundation for basic research and provide the incentive for the commercial sector to participate as basic research is costly and does not have immediate commercial application big enough to attract private investors. On the other side, non-state actors have also been prominent players in initiating technological progress and diffusion of commercial technology. Rosenberg argues that the capital goods industries in the 19th century were centres for the creation and diffusion of new techniques; the rapid rate of technological change is inseparable from capital goods firms.[73] The reason behind this is simple: to retain markets and expand them, firms need to be ahead of the competition. Technological progress and diffusion guarantee this, at least until the competition is restored.

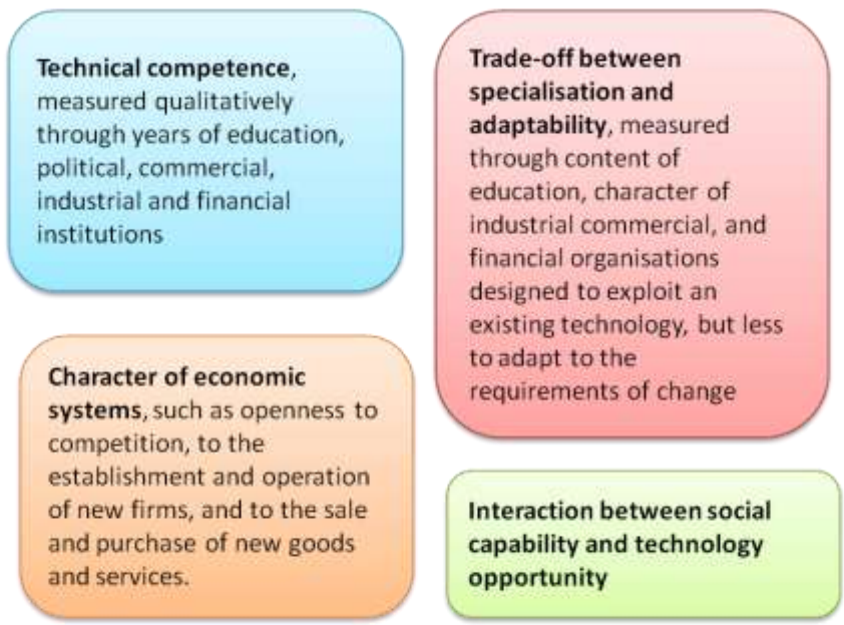
2.3.4 Determinants of Adaptation: Technological Absorptive Capability

What makes a state an innovator is intriguing. Cameron and Neal study the factors that might responsible for the rise of Britain as the world's first technology frontier during the industrial revolution. A combination of factors is believed to be behind British success as technology innovators: political creativity, economic freedom, consumer opulence and a superior cultural and scientific level.[74] They emphasise reduced state interference in economic life, as initially argued by Adam Smith, as conducive for innovation. They also note that it was the role of practical scientists, not first-rate researchers who contributed significantly to innovation creation.

Lall (1980) argues that the nature of technological change in developing countries is different from that in developed countries; it calls for skills and resources that are not normally attributed to developing countries.[75] In order to succeed in the catch-up process, argues Gerschenkron, the latecomer countries have to develop 'new institutional instruments'. This materialised as organisations capable of identifying the most promising options ahead and mustering the necessary resources for exploiting the opportunity.[76] The preconditions needed to be present in order for latecomers to have the ability to develop and exploit knowledge commercially are also known by various names, such as social capability, technological capability, and national innovation systems.[77]

Following Gerschenkron, Abramovitz offered his own version of 'absorptive social capability' (see Figure 2.1 Absorptive Social Capability).[78] Gerschenkron's version of social capability focuses on the interplay of four factors: technical competence, trade-off between specialisation and adaptability, the character of the economic system and interaction between social capability and technology opportunity. He details indicators for each factor. Both Gerschenkron and Abramovic's concepts are derived from their studies of European countries and the US. The emergence of NICs brought about a different nuance to the concept. Obviously, Latin American and Asian countries did not face the same circumstances as Germany and other countries at the time of their industrial catch-up period with the Great Britain in the 19th century.

Figure 2.1 Abramovic's Tapestry of Absorptive Social Capability



Source: Abramovic, M. (1986). 'Catching Up, Forging Ahead, and Falling Behind'. *The Journal of Economic History*, 46 (2), pp. 385-406

Lall argues that in the case of NICs, it was 'technological learning' that played a crucial role. Learning consists of technological mastery (learning to use simple production technologies) and technology deepening (adding value) which is needed to progress from adaptation to innovation. [79] Using a case study on South Korea, Kim raised the term 'technological capability', which he defines as the ability to make effective use of technological knowledge in an effort to assimilate, use, adapt and change existing literature. This is also known as 'innovation capability', referring to the ability to create new and useful knowledge based on previous knowledge. In some cases, firms or countries receive transfer of technology but are not able to innovate. For example, Taiwan and Malaysia have mastered the technologies needed to produce electronic hardware and software, but only Taiwan is capable of making an innovation.

Fagerberg and Srholec (2008) believe the aforementioned terms are overlapping; hence they propose metrics to define innovation systems. The system comprises 25 indicators, tested against a sample of 155 countries over a three-year period 1992-1994 and 2002-2004 (See Table 2.4). However, not all indicators can be used in the actual research due to the unavailability of the data.

Table 2.4 Measuring Technological Capabilities

Aspect	Measure	Capability
Science, research and innovation	Scientific publications, patents, R&D (total/business), innovation counts	Technological
Openness	Openness to trade, foreign direct investment, *technology licensing, immigration*	Technological
Production quality/standards	International (ISO) standards	Technological
ICT infrastructure	Telecommunication, internet, computers	Technological
Skills	Primary, secondary and tertiary education, *managerial and technical skills*	Technological and social
Finance	Access to bank credit, stock market, *venture capital*	Technological and social
Quality of governance	Corruption, law and order, independence of courts, property rights, business friendly regulation	Social
Social values	Civil activities, trust, tolerance	Social
Type of political system	Civil (political) rights; checks and balances; democracy or autocracy	?

Source: Fagerberg, J. and Shrolec, M. (2008). 'National Innovation Systems, capabilities and economic development'. *Research Policy* No 3, pp.1417-1435.
Indicators in italics were not included in the final research due to unavailability of the data

2.4 Technological Development Models and the Globalisation of Technology

Technology diffusion occurs across firms and countries in various patterns. Vernon's international product life cycle and Akamatsu's flying geese paradigm are two prominent theories with objectives to explain the pattern of technology diffusion in different contexts. Vernon sought to explain technology diffusion according to the life-cycle stage of a product, whereas Akamatsu sought to explain how technology diffusion could occur regionally using the case of Japan and Asia as a region.

The consequence of technology diffusion is the creation of regional and global production networks, which open opportunities for small countries and small firms to compete with their bigger counterparts, and seize position in the network by honing their competitiveness. Porter (1990, 2000) argues that competitiveness might be explained through two concepts: the diamond model and value chain. Central to this concept is the role of clusters or industrial districts as the sources of innovation.

2.4.1 Technology Development Model

Literature on technology development identified different patterns emerging across different regions. The various patterns usually referred, though not rigidly, to the Western, Soviet, East Asian and African models. Although variations also exist in each of these models, the primary features are more or less the same. For example, the degree of state intervention in the East Asian model might be different from Japan to NICs, but there is a common consensus that one of the main features of NICs is the presence of the 'developmental state' - market economies in which the state performs a highly interventionist role - though the degree and the nature of its involvement may be different.[80] Each of the technology development models and their characteristics are defined in Table 2.5 Technology Development Paradigms.

Each of the models brings out their own highlights. The Western model, usually refers to the United States and Western Europe is characterised by a limited government role and market driven economy. As the first to industrialise, no doubt innovation and competition are among the hallmarks that differentiate the Western model from the 'latecomer' model. One characteristic stands out: the evolution of the western model through vertical and horizontal disintegration. The first was attributed to firms in the United States, while the latter was attributed to the existence of forms within industrial districts in the United Kingdom. Disintegration refers to the degree of specialisation within the industry sector. Whereas vertical disintegration- as coined by Rosenberg (2003)- can be defined as the emergence of new intermediate markets that divide a previously integrated production process between two sets of specialised firms in the same industry.[81] In other words, vertical disintegration occurs when a company sheds its value chain to outsource from new specialist firms. The result of vertical disintegration is the creation of different levels of industry activities from supply chain at the bottom of value chain to the prime contractor/integrator at the top of value chain. Horizontal disintegration will be discussed in the later part of this section (under section on industrial district/cluster).

Table 2.5 Technology Development Paradigms

MODEL	Western	Soviet	East Asian	African
PARADIGM	• Market driven/limited government role • Vertical disintegration • High innovation • Huge research and development budget • High competitiveness • Capital intensive • High productivity	• Central planning • Labour intensive • Low cost production • Reverse engineering • Minimal innovation • Low competitiveness	• '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	• Evolutionary • Agricultural based • Labour-intensive

Source: Matthews, R., *lecture on Management of Defence Technology*, Masters of Strategic Studies, RSIS Singapore, 2010.

The Soviet model is the opposite of western model. It is strictly controlled by state through central planning, and thus gives no incentive to competition and innovation. The highlight of this model is the use of scale and capital goods production. Major sources of Soviet growth are substantial increases in labour-participation rates (ratio of the labour force to population), rates of investment, and education enrolment rates.[82] Huge capital investment was made, and the result is huge scale of employment in manufacturing, mining and textile industries- the latter absorbed around 20 percent of total workers in large-scale industry.[83] The state encourages the expansion of a capital goods sectors especially fuel, iron, steel and machine building rather than consumer goods. The Soviet model achieved its peak during the 1950s, and despite its inefficient allocation of resources it managed to achieve substantial rates of growth, then suffered from negative growth soon after. The Soviet model captivated many LDCs to emulate the centrally planned economy, but soon LDCs learned that the economic model could not sustain growth.

The East Asian model is a hybrid of different development models. The highlight of this model is the emphasis on the technology absorption and deepening. East Asia is a combination of western preference for a market-driven economy and Soviet inclination towards a strong interventionist state. The result is rapid economic growth, which propelled the NICs into a new class of developing countries, striding close in on developed countries. The East Asian technology development model relied heavily on technology transfer from abroad and the astounding absorptive capability, which enabled them to adopt, indigenise, and improve the technology.

2.4.2 International Product Life-cycle Theory

Various theories have tried to explain factors that shape and change the international trade pattern. Ricardo's comparative advantage and Heckler-Ohlin factor endowment, which argue that variations in national endowment, intimately linked to state preference for production of goods, cannot give satisfactory answers to this peculiarity in the international trade pattern. The peculiarity includes, among others, why Japan export automobiles and Switzerland export pharmaceutical product, and why most of new products in the twentieth century were made in the United States.[84] Vernon argues that the pattern of international trade is not only shaped by comparative advantage or a country's factor endowment *per se,* and proposed that the product life cycle correlates to a diffusion of technology that determines a country's place in the international trade pattern.

Vernon explains that US ability to link technology with commercial application to create a new product is the result of interplay between high unit labour cost, relatively unrationed capital compared with other markets and the awareness of US entrepreneurs to satisfy new wants associated with high income levels of high unit labour cost.[85] He discovers that new products originated from the US are produced locally despite demand growth in overseas markets, and inquired when, where to and why US firms decide to relocate their operation abroad. He creates what later became known as the product life cycle (PLC), which basically explains three stages through which a product must evolve: the introduction stage (new product), the maturity stage and the standardised product.

The first stage is characterised by the non-standardised nature of the design which indicates the degree of freedom they have in changing inputs, the price elasticity of demand for the output of individual firms is comparatively low, and the need forswift and effective communication on the part of the producer with customers, suppliers and competitors.[86] In other words, there is only limited demand from abroad at this stage, which can be addressed through export but there is not enough reason for firms to relocate the manufacturing nearer to the market.

The second stage is characterised by the maturing of product design and increasingly sustained demand from abroad. At this stage, production cost is determined by scale and different labour costs. If the latter is large enough to offset transport cost of exporting back to the United States, it becomes possible to relocate the firm's production abroad. Also, the technology-importing countries' concern with balancing trade and economic loss due to import, provide the pull factor for foreign investment. This investment is steered towards employment creation and import substitution.

The third stage is characterised by a product that is well-articulated, easily accessible by the international market and sold on the basis of price. At this point, even low cost labour might be the first point of attraction in relocating; there are other considerations as well.

The paradigm postulated that innovator countries would evolve from being the producer of new technology to the importer of the same technology (though less valuable) as they move on with new higher value-added technology for export. The consumer of technology will evolve to become the producer, only after the technology reaches maturity. Relocation of production to LDCs is due to cheaper labour price. However, industries relocated to LDCs are not producers of standardised, high value-added products and do not require a sophisticated industrial environment. This is because the LDCs are lacking in vertically-integrated self-sustaining industries, i.e. manufacturing processes dependent on skilled labour, repairmen, reliable power, spare parts, standardised industrial material and so on.[87] Innovation, scale economies, and other factors in international trade work to affect the strength of import substitution strategy in LDCs.

Vernon's product life-cycle scholarship was criticised due to its ethnocentricity, if seen from a non-US perspective.[88] Many products are now firstly introduced and produced in other countries, such as Japan and Europe. Deardoff questions the implication of Vernon's theory: whether the developing countries can only grow by expanding in industries that developed countries must then leave behind, and whether the established producers would act to limit the opportunities of newcomer.[89] Vernon's product life cycle, if true, is a grim prophecy for LDCs.

2.4.3 Flying Geese Technology Diffusion Model

An oriental version of the technology diffusion model is perhaps best represented by the paradigm of (a flock of) flying geese, first coined by Kaname Akamatsu and used as Japanese propaganda during World War II. Akamatsu used the flying geese model to explain the phenomenon of industrial development in a catching-up economy, on the basis of Japan's experiences in catching-up with the West.[90] He projected this paradigm on to the East Asia region with Japan as the leader of the flock. Central to this paradigm is the import-production-export sequence of activities which occurs for each product in the industrialisation process: the first stage is characterised by the follower economy beginning to import foreign goods, which gradually kick-starts local industrial development; the second stage is marked by the start of import-substituting production with either local or foreign capital or a combination of both; the third stage is signified by increasing local production that exceeds local consumption, and thus excess goods start to be exported.[91]

The flying geese paradigm was criticised for various reasons.[92] First, it shows an overly harmonious picture of multilateral relations by believing that the paradigm will create an interdependent economy in East Asia. Second, Akamatsu did not elaborate further on the mechanism of technology transfer through trade. Third, Akamatsu underlines the importance of TNCs and FDI while in reality FDI does not automatically lead to technology transfer. Fourth, it is not clear as to how and whether Japan will always be the leader of the flock. China with its rapid economic growth has the potential to overtake Japan's leadership position.

2.4.4 Value Chain and Industrial Clustering supporting Firm Competitiveness

Vernon's product life cycle and Akamatsu's flying geese models convey a grim message regarding the fate of LDC's technology development. Porter (1990, 2000) suggested that there are other factors to determine a country's competitiveness in the international trade pattern. Porter argued that competitiveness is not given; it has to be created. To understand this, Porter proposed the 'Diamond model' which seeks to explain firms/countries' performance in the international market, based on the interplay of four factors: factor endowment, domestic demand conditions, related and supporting industries, and domestic rivalry.

According to Porter, country competitiveness depends on the functioning of the four factors at play. Factor conditions refer to the ability to turn basic advantage, i.e. natural and human resource, into specialised advantage. Firm rivalry refers to the rules and incentives by which the intensity and type of rivalry are shaped. The 'good' rivalry is one that encourages innovation, as opposed to the 'bad' rivalry that only creates imitation and price war. Demand conditions can be divided into local and global demand. The presence of sophisticated customers will force firms to move from imitating to innovating and differentiating, while global demand provides scale and enforces higher standards. All four forces need to be present in order to create conditions for competition, which will lead to emergence of innovation. The result of Porter's model is a prediction on international trade patterns, in which countries will be exporting products from industries where all four components of the diamond model are favourable.[93]

Another attribute of national advantage is the presence of internationally competitive suppliers or related industries. When related and supporting industries make investment, the benefit could spill over to other industries that help the economy to achieve strong competitiveness. There are two concepts linked intimately with this factor. The first is the value chain and the second is industrial clusters.

A value chain refers to a chain of activities for a firm operating in a specific industry, but it can also be applied to the industry level dubbed 'supply chain'. It stipulates that different economic activities are necessary to deliver a products or services. Each of these activities contributes different values, which are mobilised into an integrated value-chain system. This system encompasses not only firms' suppliers but also the firm itself, its distribution system, and buyers. Every company should seek to configure its own value chain with the aim of lowering production cost, while at the same time maintaining the value of those assets that lead to differentiation. A value chain can be created through vertical or horizontal integration. Horizontal integration refers to a consolidation of many firms that handle the same part of the production process, as opposed to vertical integration, which refers to the degree to which a firm connects to its downstream suppliers and its upstream buyers.

Another concept linked to competitiveness is that of clusters, which have been acknowledged as an important part of modern industry. Clusters refer to a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities.[94] Porter mentioned the concept in his seminal book *The Competitive Advantage of Nations* (1990), which triggered the creation of clusters around the world. Clusters originated from the concept of 'industrial districts', discovered by Marshall back in the nineteenth century. It refers to an area where a concentration of firms has been established.[95] Marshall was studying the reason why small British enterprises are able to compete against their larger integrated counterparts in the United States when he stumbled upon the fact that most important industries in the England like cotton and wool industries were gathered in the same location.

Marshall distinguished industrial districts from 'localisation', but acknowledged that the first can arise from the latter. Localisation refers to the existence of a concentration of industry in a certain location for various reasons, which may include the need to be close toresources, and the existence of demand for products with high quality. Localisation could transform into an industrial district when the following preconditions are met: first, it gathered skills; second, it grew into subsidiary trades; third, there was the widespread use of highly specialised machinery; fourth, it provided a local market for specialist skills. Belussi and Caldari added two more preconditions, which are the emergence of industrial leadership and the introduction of novelties into the production process.[96]

The advantage of industrial districts is the closeness among small firms that encourages a division of labour to create horizontal integration, which is typified by one firm engaged in different parts of production (e.g. growing raw materials manufacturing, transporting, marketing, and/or retailing). Such integration was made possible because of the peculiar way the industrial district operates. First, competition and cooperation seemed to work side by side in an industrial district. Second, the collection of small and medium enterprises created external economies. Marshall argues that the external economy helps to strengthen small and medium enterprises (SMEs) to compete with larger firm.

Clusters, on the other hand, are not just about a single industry. They encompass an array of linked industries and other entities imperative to competition. Various actors exist in a cluster, to include suppliers of specialised inputs, government and non-government institutions - such as universities, trade associations as well as foreign firms. It is not easy to draw a cluster's boundary. First, it takes a thorough understanding of the linkages and complementarities across industries and institutions that are most important to competition in a particular field; second, it is difficult to determine the strength of these spillovers and their importance to productivity and innovation.[97] Spillovers can be understood in terms of technology, skills, information, marketing, and also demand that cuts across firms and industries.

Porter notes that different clusters in a region can overlap with one another, with different degrees of interdependence. For example, information technology, communications equipment, aerospace vehicles, and defence have a tendency to overlap, so do clusters in the fields of plastic, chemical products and oil and gas.[98]

2.5 Latecomer Technology Development Through 'Strategic' Industrialisation and Procurement of Military Technology

What choice do latecomers have when it comes to technological development? There are two alternatives by which a particular technology can be mastered: autarchic and foreign technology acquisition. The first refers to creation or re-creation of technology by locally providing all of the necessary elements through developing the related technology capabilities. While it guarantees the acquisition of at least rudimentary proficiency in related capabilities, it is usually very costly, time consuming, and would likely result in perpetuation of backwardness of the latecomer. The second choice involves opening the door for foreign technology, to be established and operated domestically. While this might provide more guarantees in generating employment and foreign exchange, without the appropriate policies this does not automatically means a strong contribution to development of local capability. Even worse, this could also undermine the existing domestic capability – due to an inability to compete, or perpetuate dependency on foreign technology.

Government has critical role in technology development through facilitating the process of acquiring technological competence.[99] First, when the technology is highly sophisticated, it entails substantive set-up costs and scale economies, as well as strong backward and forward linkages (externalities). Second, due to a 'gestation lag' in technology absorption, industry needs state protection from competition with foreign firms. Third, the state needs to act as a catalyst for coordinating the investment behaviour of related sectors or enterprises to fix the problem of coordinated development between sectors with strong interlinkages. Counter-arguments for state intervention include the resolution of 'rent-seeking' and informational problems that are likely to prevent the state from performing effective intervention.[100]

Public procurement has been used as one form of government intervention in both industrialised and industrialising countries. Industrialising countries in Asia, such as Singapore, Malaysia, and Indonesia, since the 1980s have used defence procurement for both industry and technology policy objectives with mixed results.[101] Why do these countries use government intervention in the form of public procurement and the targeting of arms producing industry? Understanding the context is important, as industrialising countries in this region are facing different dynamics compared to their counterparts in the west that affect the way countries procure and market weapons.

The next subchapter will discuss the imperative role of public procurement in the development of industry and technological capability, specifically through procurement of arms as 'public goods'. Military technology has potential externalities for both defence and development, which renders the technology-absorbing industry as 'strategic'. This provides the option for the use of offset as a conduit of technology transfer.

2.5.1 Public Procurement as Industry and Technology Policy Tool

Public procurement is seen as one of the most promising innovation and industrial policy tools of both developed and developing countries. While the conventional wisdom is to acquire a cost efficient solution achieving value for money through competition, some of the most industrialised countries have actually been using public procurement for secondary purposes. The US has a 'Buy American policy' which basically aims to lessen dependency on foreign technology, including license production of imported goods.[102] The EU has initiatives and directives since 2005 to use public procurement as tool for achieving a range of goals, to include the promotion of innovation, sustainability, and regional economic growth.[103] It is no wonder that developing countries also follow a similar path. For example, South Africa used public procurement for "wealth redistribution".[104] Most developing countries also perceive public procurement as strategic; this is why only few subscribe to the WTO's General Procurement Agreement (GPA). GPA mandates asigning party to apply the principle of openness, transparency, and non-discriminationin national public procurement.

Public procurement holds significant value in real terms. The government spending in OECD countries has averaged almost 30 percent of their GDP. Public procurement is also the biggest domestic market in LDCs, and can account for up to 50-70 percent of imports.[105] As consequence, it has the potential to influence markets in terms of production and consumption trends. A number of empirical researches have confirmed that public procurement has the potential to elicit stronger innovation impulses than subsidies for R&D. [106]

There are at least two strategies on how government uses procurement as an industrial policy. The first is industrial policy through procurement strategy of 'making', where domestic firms conduct the R&D and manufacture, which is called Public Procurement for Innovation (PPfI). [107] Public agencies can support innovation through procurement: creating new market and demand pull pressures, providing a testing ground for innovative products, and potentially encouraging innovation through lead markets for new technology.[108]

Using procurement as innovation policy is not without its problems. Kattel and Reiner point out that government has capacity problems, is infamously known for underperformance due to the lack of competitive pressure, lacks proper institutional settings in terms of over or under regulation and organisational set up, and lackspolicy and administrative capacity. Furthermore, public procurement tends to have many objectives, such as cost savings, value-for-money, transparency, which often contradict each other or conflict with wider policy objectives. Finally, the PPfI process is costly and time consuming, demands strong coordination between stakeholders, and constant evaluation and learning.

The second strategy deals with procurement from abroad, which is also seen as a potential conduit for technology transfer. This is where offset comes on to the scene. The offset strategy is costly and often a knowledge-intensive process, which demands investment in worker training, new capital equipment and plants, information collection, and product and 'process debugging'.[109] Also, the technology adopted is not new because the technology has reached maturity or has been battle-proven in the case of military technology. The benefit of technology adoption is that the receiver might get an improved version of the original technology at less risk.

2.5.2 Defence Industry as a Strategic industry: Leading Edge Technology and Spillovers

One major question that needs to be asked for facilitating technology absorption is: who will be the target of such a policy? In other word, which sector and industry is deemed 'strategic'. Krugman points out that in most cases of government targeting, it is not clear as to what criteria is used to justify the target.[110] When List advocates 'infant industry' policy he makes it clear that the intervention should not be random, but selective and discriminatory.[111] According to Krugman, criteria for government targeting fall into two groups: popular criteria and the economists' criteria.[112] The first group includes high value-added per workers, linkage industries, future competitiveness, and responding to other governments. These criteria are popular, because they are subject to discussion in books and articles aimed at a wide audience, except, ironically, the economist. The second group, which Krugman says is more sophisticated than the first, includes economies of scale and imperfection competition as well as external economies.

Why target the defence sector for technology development? Apart from the obvious motive of achieving military sovereignty, defence industry has been one of the most regulated sectors because it reflects both public goods – non-exclusive and non-rival - and advanced technology. Eliasson points out that defence as a public good contains an inherent dilemma; if the state cannot control supply, there will be no incentive to invest privately in production for a market.[113] In fact, the role of government is central to understanding defence industrialisation because it is a major buyer - sometimes the only buyer (monopsony) - hence its buying power affects or even determines the size and ownership of its national defence industry, its structure, entry and exit, prices, efficiency and profitability.[114] Arms procurement has some distinct characteristics that make it suitable for an interventionist industrial policy, but at the same time the same characteristics could also be responsible for why it cannot be used as effective industrial policy. According to Ball, arms procurement has specific characters that include cost; national security; time periods; complexities; arms control regime; and national legislation.[115] Arms procurement has its own standard, such as political and security considerations that go beyond value-for-money arguments, secrecy that limits transparency, long acquisition cycles, complexity of process that require management teams with multi disciplinary competence.

The nature of military technology as advanced technology comes from the fact that military organisation has a tendency to demand the most sophisticated weapons. This is understandable, particularly in the era of military transformation, where technology has become a vital element of superiority. Furthermore, some military technologies are acknowledged to be 'critical' or 'strategic' due to their potential spill-overs, so great that they will lead to technological advancement in non-defence sectors. The linkages between civilian and military technologies are usually understood through the concept of 'spin-off' and 'spin-on' effects. Spin-off simply means that effects are directed from military R&D and production to the civilian industries, while spin-on are the effects from the reverse direction. While the effects can be tangible or intangible[116], spin-off implies not only that a linear relationship exists between military innovation and civilian application but also carries the argument that the military can act as the primary agent of technology innovation. The peak periods of technology transfer frequently accompany or cluster around the event of warfare[117], arguably because of colossal military demand during wartime. Nothing ensures replacement like organised destruction.[118]

Armament production has also been viewed as a 'technology locomotive', which can incite the growth of new industries and other technologies such as aerospace, electronics, and information technology.[119] In the case of Sweden, the Gripen fighter jet project is estimated to produce spill-overs equal to 300 percent of the procurement contract value.[120] In Japan, aerospace, defence and commercial industries are sharing facilities and human resources- and represent lead industies due to high value-added production, rapid output growth, knowledge intensive innovations, and horizontal and vertical industrial linkages with the wider economy.[121]

How exactly is defence industrialisation influencing the technical progress of a country? In the case of the US, military R&D has accounted for the majority of government spending; therefore it influences the direction of technical progress.[122] However, Shankerman and Pakes (1986) find that patents from military R&D are of weak economic value, while estimations by Lichtenberg show that the average returns from private and military R&D are 33.9 percent and 0.7 percent respectively.[123] Cowan and Foray point out there are some technological fields where military R&D may still generate results useful in the civilian domain, while in others it is no longer the case.[124] Herring identifies specific product innovations that have flown from military laboratories to civilian production and vice versa as proof that military R&D and civilian R&D now have closer relationships through spin off and spin on (Table 2.6).

Table 2.6 Impact of Spin-Off and Spin-On of Specific Product Innovation

Period I (1946-mid 1960s)	
Military technology	**Civilian application**
Bombing radar system	All-weather civil air transports
Tactical field radios	Police, safety, rescue communications
Fire control computers	Industrial process control systems
Infrared sensors	Geological mapping
Radar magnetrons	Microwave ovens
Satellite systems	Communication satellites
Period II (1960s-)	
Civilian technology	**Military application**
Integrated circuits	Command control systems
Space-based sensors	Military intelligence
LSI, VLSI	Cruise missile guidance
Fiber optics	Missile guidance
Electro-optical devices	Intelligence sensors
Lasers	Target designation, range measurement
Artificial Intelligence	Smart weapons

Source: Samuels, R. (1996). *Rich Nation Strong Army: National Security and Technological Transformation of Japan*. Cornel University Press.

The relationship between military and commercial technology has become more dynamic. Military R&D budgets in United States dropped from 80 percent of federal R&D spending in the 1950s, to below 50 percent during the 1949-2005 periods.[125] Longer development time, increasing cost and risk of leading edge technology as well as limited production scale have stripped away the competitiveness of military technology. Civilian technology now leads in some sectors, particularly Information Technology, to the advantage of bigger scale and a shorter technology life cycle. The best economic alternative is the path of dual use policy to enforce 'de-compartmentalisation' of the civil and military spheres, systematically guaranteeing diffusion of technological innovations to and from the military.[126]

2.5.3 Defence Industrialisation and Global Hierarchy

Defence industry can be defined as a

> "Combination of people, institutions, technological know-how, and production capacity used to develop and manufacture the weapons and supporting defense equipment needed to achieve our [US] national security objectives. " (Office of Technology Assessment)127

This definition contains three vital elements: technology base, production base, and maintenance base. The technology base includes laboratories and research facilities of private industry, government, and university, testing centres, as well as trained scientists and technical personal to operate the facilities. The production base encompasses both government and private owned facilities, whether or not operated directly under government officials. The maintenance base includes government and private facilities and technical personal that maintain and repair equipment.

What are the necessary elements to establish and sustain arms production? Evans compiles five essential capabilities: financial resources, level of industrial development, science and education facilities, political structure and organisation, and access to export markets.[128] Financial resources refer to available capital that can be allocated for investment in the defence sector. In developing countries, this is often a dilemma due to limited resources that need to be spread across the economy - like health and education. The second capability is the level of industrial development, which is derived from the observation of Gavin Kennedy's seminal research.[129] Sophisticated weapon systems are produced from variants of metal and material that require standardisation and uniformity in specifications, hence requiring the pre-existence of technological expertise in a very broad range of disciplines and industries – such as metal and steel, metallurgy, electronics, transportation, machinery. Due to rigorous operational requirements, the production of military technology involves further specialisation beyond similar civilian applications. For example, it would be difficult to produce armoured vehicles in the absence of a transportation industry. Because the investment cost to create domestic capability will be too expensive, developing countries will tend to acquire embodied technology transferred in form of imported equipment.

The next element is scientific and education facilities to adopt technology and develop innovation. Developing countries often do not have sophisticated research programmes and facilities as well as adequate trained scientists and researchers, hence they will be dependent on foreign technology and assistance in the early development periods. An imperative in early defence industrialisation is the ability to choose which technology to adopt and the means of accessing the technology, for example through license production, offset, or reverse engineering. In the later development phases the ability to conduct massive R&D is an absolute necessity in order to initiate innovation. It is this innovation capability that separates a successful country from the laggard. The fourth element has a more political nuance, which is political structure and organisation. This refers to a government's ability to control and direct resources from the civilian economy to the defence sector. The last element is access to export markets, which reflects the competitiveness and relative progress of developing countries. Export extends an economy's scale to achieve a more economic production level, as well as resolve the classic problem faced by developing countries: bottlenecks created by high unit production cost and low domestic demand in peace time.[130]

The progress of defence industrialisation in developing countries is encapsulated in the Ladder of Production (LoP), coined by Keith Krausse[131], which starts with simple maintenance capability and gradually builds up to the highest capability to conduct independent R&D and the production of advanced weapons. The higher a state climbs, the more independent it is in arms production (autarky).

The LoP concept has been criticised for not differentiating platforms from control units and subsystems. According to Brauer, in many cases industry in developing countries only has production capability of platforms while the value-added components - engine, radar, optronics - are still imported.[132] Therefore, Brauer suggests that the ladder of production between platform and control unit and subsystem is separated.

Differences in technological capability determine the nature of arms production in a country and its relationship with the global defence business, thus shaping the hierarchy in the structure of the global defence industry. Krause, Ross, and Bitzinger each propose a categorisation of arms producing countries into three or four tiers. The first tier refers to critical innovators at the technological frontier of arms production, with the US as the main source of arms supply as well as innovation. The second tier refers to adapters and modifiers of advanced military technology. Here Krause, Ross, and Bitzinger disagree. Krause limits the second tier to mostly west European countries, Ross includes China and Japan, whereas Bitzinger divides the group into three subgroups to cover industrial countries with small but sophisticated defence industrial bases (Japan, Sweden), developing countries with a rudimentary defence industrial base (South Korea, Indonesia), and developing countries with wide range of defence industrial base but lack an independent R&D and capacity to produce sophisticated technology (China, India). The third tier is defined as those countries possessing very limited and generally low-tech arms production capabilities. Bitzinger describes the structure of global defence industry as 'hub-and-spoke', signified by dependency to the first tier as the technology innovator.

Table 2.7 Ladder of Production

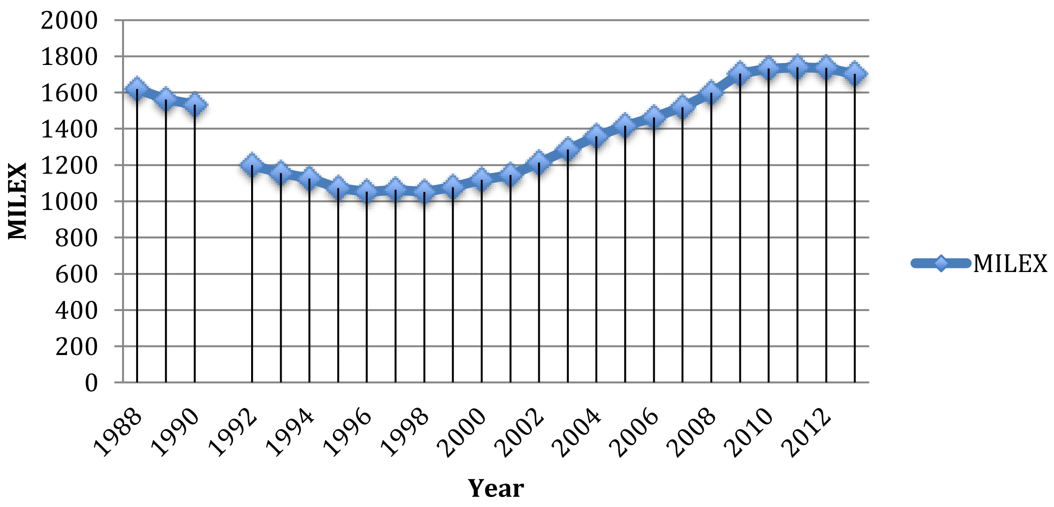
1	**Capability of performing simple maintenance**
2	Overhaul, refurbishment and rudimentary modification capabilities
3	Assembly of imported components, simple licensed production
4	Local production of components or raw materials
5	Final assembly of less sophisticated weapons; some local component production
6	Co-production or complete licensed production of less sophisticated weapons
7	Limited R&D improvements to local license-produced 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, K. (1992). *Arms and the State: Pattern of Military Production and Trade*. Cambridge University Press.

2.5.4 The Widening Gap: Globalisation and Unipolar Defence Industry

The trend in world military expenditure (MILEX) shapes the global defence industry structure, because MILEX represents access to R&D and procurement spending that is essential for the development of new products and large production runs that provide economies of scale. Figure 2.2 shows the world military expenditure throughout 1988-2013 in 2013 current prices has been more or less a rollercoaster ride. The figure demonstrates a bounce back by the late 1990s, following a major reduction of military expenditure after the Cold War ends. This reduction occurred in parallel with a rapid increase of unit production cost of weapons triggered by the RMA.[133] The massive scale of restructuring, mergers and acquisition took place across North America and Europe to cope with declining demand for arms production and a new approach was introduced to arms acquisition and arms export.[134]

Figure 2.2 World's Military Expenditure, 1988-2013 (in US$ bn)



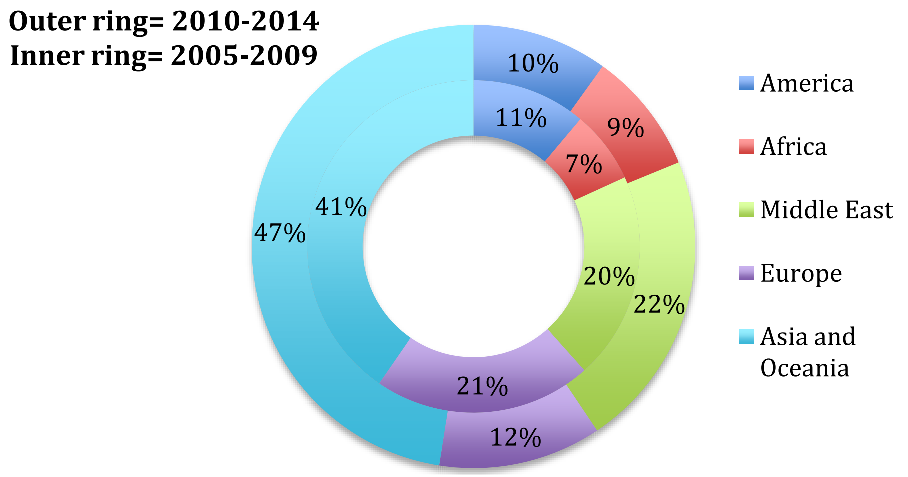
Source: SIPRI Military Expenditure Database. Available at https://www.sipri.org.arms(Accessed 29 January 2015)

A further breakdown of global MILEX demonstrates the US monopoly in spending - that until 2006 the US spent more than the rest of the world combined, and also arms production and export – the US also monopolised the global top 100 defence companies and arms exporters. US defence industry is characterised by a small number of prime contractors with far-reaching technological capabilities that allow them to focus on design and final assembly and testing of weapon systems.[135] Prime contractors rely on subcontractors to supply various electronic sensors, engines, and weapons. Driven by the need for cost reduction and export, prime contractors will frequently take on subcontractors from other countries - particularly from developing countries to meet requirements for local content.

Globalisation of defence industry is further endorsed by European countries, which have been struggling with reduced MILEX and procurement demand. Concerns have grown over the impact of the widening gap between US' MILEX and those of Europe. Cost reduction becomes a priority, for that purpose commercialisation, contractorisation, as well as inter-Europe and transatlantic collaboration are employed as procurement strategies. The latter is a major shift away from traditional, single country patterns of weapon production towards the more transnational development and manufacture of arms. There is also growing criticality of the global arms market: as domestic markets shrink, overseas business has correspondingly grown in importance with an impact on the health and survival of defence industrial base. Industry's perception of future markets and the desire for sales have globalised as well.[136] Globalisation that further ensues is characterised by a new kinds of industrial linkages, such as international subcontracting, joint ventures, cross border mergers and acquisition.[137]

Figure 2.3 below shows that the end of Cold War had created a smaller market in Europe, but Asia and other parts of the world are getting more significant portions of arms imports. SIPRI recorded a 16 percent rise in the volume of international arms transfers across 2010-2014 in comparison to that in 2005-2009. Europe recorded notable decreases while Africa, America, Asia and Oceania, and the Middle East posted increases. The share of Asia and Oceania's arms imports throughout 2010-2014 accounted for 48 percent, followed by Middle East with 22 percent.[138]

Figure 2.3 The importers of major weapons, by region, 2005-2009 and 2010-2014, percent of global share



Source: *SIPRI Fact Sheet*, March 2015

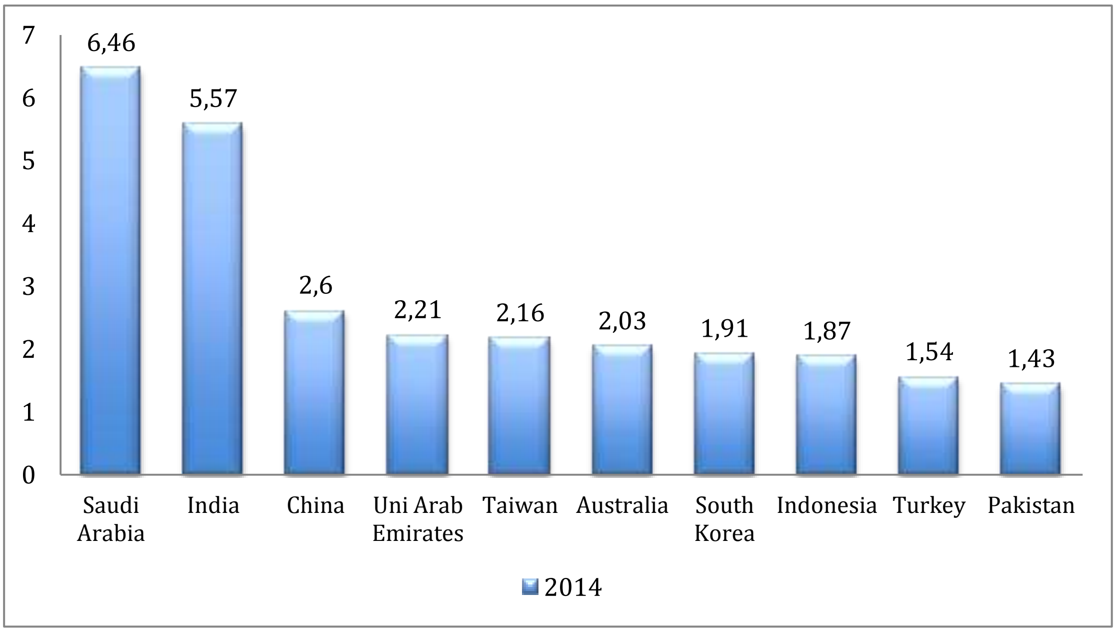
2.5.5 Catching up: Offset in Arms Procurement for Industrial and Technology Purposes

Globalisation of arms production and arms export has provided greater access for developing countries to participate in the global supply chain and the development of sophisticated technology, but it also poses other challenges. Industrialised countries tighten aid for military procurement and push for commercialisation of payment.[139] While developing countries do not have the same resources in terms of capital, skilled labour and technology as developed countries to tackle the defence burden, dropping out of defence business is not a choice and neither is self-sufficiency.

Defence industrialisation still matters for developing countries, especially in Asia. The strategic environment in Asia is not known to be benign; military sovereignty-defined as the capacity of the state to procure arms and maintain security of supply in defence acquisition is vital for assurance.Even in Southeast Asia, the presence of ASEAN and other security architecture does not change the fact that the region remains laden with flashpoints. For Indonesia, which has no strategic assurance, procurement of arms has been an imperative in safeguarding strategic sovereignty. But how do the developing countries secure defence industrialisation?

Figure 2.4 describes top defence importer worldwide in 2014 according to a report by Jane IHS. It puts six Asian-Australasian countries in the world's top ten of arms importers; they are India (2nd), China (3rd), Taiwan (5th), Australia (6th), South Korea (7th), Indonesia (8th), and Pakistan (10th).[140] With recent strong economic growth, Asian countries are able to spend more on defence and support the continuation of defence industrialisation. Frost & Sullivan note that with massive procurement programmes in Asia Pacific and the Middle East, offset deals are anticipated.[141] While the bargaining power of a country varies in correspondence to its buying power, offset has been accepted as a norm in the arms trade in Asia and the Middle East. While arms exporting countries in Europe are now looking for growing markets in developing countries to compensate for reduction of demand at home, growth in military expenditure in Asia provides the opportunity to do so. What it creates is more or less a situation of '*quid pro quo*' in which the bargaining power shifts to the Asian country, as the buyer, when negotiating offsets.

Figure 2.4 Top Defence Importers Worldwide in 2014 (in US$ bn)



Source: IHS Global Defence Trade Report 2015.

2.6 Summary

The chapter has evaluated various influential development strategies crafted over the last 50 years, critically reviewed the role of technology in fostering industrialisation in developing countries, and various strategies of technology development across different economic systems. While technology can be transferred and diffused, it is not free, and comes with barriers and costs. The imperfection of the technology market calls for government involvement, which can span from subsidy to public procurement. Two points need to be highlighted: first, procurement of military equipment - which inherently contains high technology - has been used as a technology and industrial policy tool by developing countries. Second, offset through arms procurement has become a conduit for technology transfer that brings the promise of positive impacts to both defence and development in developing countries. Arms trade offset as a public procurement policy tool is arguably befitting developing economies like Indonesia through the establishment of rudimentary defence industrial capability. Globalisation provides cost efficiency but more dependency on foreign technology; while autarky secures independence but not economic viability. Offset perhaps emerges as a third choice, aiming to use foreign arms procurement for the benefit of national security, both military and economic.

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3 In economic sense, development can be defined as "economic growth accompanied by a substantial structural or organisation change in the economy, such as shift from a local subsistence economy to markets and trade or the growth of manufacturing and service outputs relative to agriculture", while growth is total output may occur either because the inputs of the factors of production (land, labour, capital) increase or because equivalent quantities of the inputs are being used more efficiently. See Cameron, R. and Neal, L. (2003) *Op.Cit.*, pp.8-9.

4 Knox, P., Agnew, J. and McCarthy, L. (2003). *Op.Cit.*

5 Knox, P., Agnew, J. and McCarthy, L. (2003). *Loc.Cit.* For example, positive deviation takes place in North America, Europe and Australasia; with the largest deviation takes place in socialist counties such as China, Cuba and Vietnam. Negative deviation takes place in oil-rich Southwest Asian/Middle East such as Iran, Iraq and Saudi Arabia as well as African countries like Algeria, Angola, Libya, Namibia and Nigeria.

6 HDI is measured through physical well-being, education (adult literacy and mean years of schooling) and standard of living (measured by GDP/per capita, adjusted to PPP). GSDI is measured through employment levels, wage rates, adult literacy, years of schooling and life expectancy.Available athttp://hdr.undp.org/en/statistics/ (Accessed 25 July 2011)

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20 Externalities can be divided into two: technological and pecuniary externalities. The first is direct external effects that do not arise as a result of market transactions for which priced are charged. The latter arise whenever the profits of a producer are affected by the output and input levels of other producers. Weiss, J. (1988). *Industry in Developing Countries*. Croom Helm. pp. 95-96.

21 Todaro, M. P. (1989). *Op.Cit*. pp. 99-100. Myrdal named this process as 'circular cumulative causation', in which low incomes lead to low level of living which keeps productivity low, which generate low income, and so on.

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108 Kattel, R and, Lember, V. *Ibid*.

109 Evenson, R.E., Westphal, L.E., (1995) *Op.Cit*.

110 Krugman, P.R. (1983) 'Targeted Industrial Policies: Theory and Evidence' in *Industrial Change and Public Policy*, Federal Reserve Bank of Kansas City, August 1983. Available at https://www.kansascityfed.org/publicat/sympos/1983/s83krugm.pdf. (Accessed 11 December 2014)

111 Shafaeddin, M. (2000) 'What did Frederick List Actually Say?'. *United Nations Conference on Trade and Development Discussion Paper*, No.149, July 2000. List mentions a number of criteria: industries that produce articles of general consumption; industries that require large capital, general knowledge, much dexterity and experience; industries which provide linkages with others; industries that employ a number of laborers and consume great quantities of agricultural produce and raw materials; industries which can be supported by machinery and by a great internal consumption. List denies industry of luxury from government support until the country arrives at the last stage of development, which is agricultural, manufacturing, and commercial (service).

112 Krugman, P.R. (1983) *Op.Cit.*

113 Eliasson, G. (2010) *Advanced Public Procurement as Industrial Policy: The Aircraft Industry as a Technical University*. Springer.

114 Hartley, K. 'Defence Economics and Industrial Base'. Unknown date of publication. Available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.196.5575&rep=rep1&type=pdf. (Accessed 5 January 2015)

115 Ball, N. (1991) 'The Political Economy of Defence Industrialisation in the Third World' in: Ross, A. L. (ed.) *The Political Economy of Defence: Issues and Perspectives*. Westport, Connecticut: Greenwood Press, pp. 175-202

116 Varynen, R. (1992) *Op.Cit*. Military Industrialization and Economic Development. UNIDIR. The **tangible effect** would be derived from the direct transfer to commercial uses of specific products, processes or materials developed in the military sector. The **intangible spin-off** effect is created by the indirect contribution of military-industrial knowledge to commercial operations by the transfer of technical innovations, organisational solutions and managerial techniques.

117 Cameron, R. and Neal, L. (2003), *Op.Cit.*

118 Samuels, R. (1994), *Op.Cit.*, p. 20

119 Bitzinger, R. (2004). 'A Brave New Arms Industry'. *Adelphi Paper,* IISS.

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[133] Finnegan, P. 'The Evolution of International Defense Hierarchies' in: Bitzinger, R. (ed.)(2009). *The Modern Defence Industry: Political, Economic, and Technological Issues*. Praeger Security International, pp. 95-106

[134] Military transformation that brings successive generations of weapon systems has increased the cost of arms production, not only due to rising manufacturing costs but also military R&D, more complicated operating and maintenance procedures, requirement for highly trained personnel and more intricate spare parts. The use of cheaper commercial off the shelf, in some cases can reach up to 80 percent of the systems, does not dampen this trend. Private companies are more welcome and seize expanding role in providing research, production, and services but the progress is uneven in the US and Europe.

[135] Finnegan, P. (2009) *Op.Cit.*

[136] Neuman, S. G. (2010) 'Power, Influence, and Hierarchy: Defence Industries In A Unipolar World'. *Defence and Peace Economics*, 21(1), pp. 105-134

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3. DEFENCE OFFSET AS A VEHICLE FOR INDUSTRIAL AND TECHNOLOGICAL DEVELOPMENT

3.1 Introduction

At the intersection of the scholarship on the international arms trade, technology transfer and countertrade lies offset. As a concept it is fetching, as a practice it is proliferating, and as a policy it is frustrating. Industry sees offset as a complication that threatens to shrink profit margins and potentially cultivates future competitors, but it is also aware of its importance in securing arms exports. The World Trade Organisation, the regime promoting liberal trade and free markets, explicitly prohibits the use of offsets as one of the criteria for awarding contracts due to the market distortion it potentially causes.[1] The US, the world's biggest arms exporting country, finds offset to be 'economically inefficient and trade distorting'[2]. The European Defence Agency (EDA), while acknowledging the potential benefits of offsets, has recently encouraged member states to limit offsets and practice abatements.[3]

Offset has been dubbed "a necessary evil that would never exist in a perfect world".[4] Demonstrating that the world is imperfect, offset practice has been proliferating to an alarming level, so much so that it is feared it might become a market inhibitor in the future.[5] The use of mandatory offset means countries tend towards excessive demand of offset requirements and stringent implementation rules.[6] A study undertaken by Avascent and Fleishman Hillard warns that global offset obligations in the aerospace and defence industry are expected to grow by US$ 50 bn per annum going forward to 2017.[7] This number is remarkable considering the 2014 value of global arms stands at US$ 64.4 billion, which means the value of offset is nearly the same as that of global arms sales.[8] Countries in the list of top ten defence importers in 2014 are offset practitioners, eight of which have mandatory offset policies (see table 3.1.).

There is concern that policy shift towards stringent offset has taken place in the absence of an ample understanding of the real costs and benefits of offset. When offset is used in the arms trade, conducting offset evaluation becomes problematic. In 2010, Transparency International strongly asserted that offsets should be banned for a number of reasons, alleging that offsets are prone to corruption.[9] So far, only few countries have embarked on a serious effort to evaluate offset, such as the US, Sweden, Finland, Australia, and the UK.[10] Demand for offset audit and accountability have been articulated[11], which meet traditional concern that by doing so will endanger national security and reveal trade secret.

Table 3.1 Top Defence Arms Importers, 2014

No	Country	Offset policy	Offset practice
1	Saudi Arabia	Yes	Yes
2	India	Yes	Yes
3	China	No	Yes
4	UAE	Yes	Yes
5	Taiwan	Yes	Yes
6	Australia	No	Yes
7	South Korea	Yes	Yes
8	Indonesia	Yes	Yes
9	Turkey	Yes	Yes
10	Pakistan	Yes	Yes

Source: Author, compiled from online resources https://www.ihs.com/info/0214/balance-of-trade.html. (Accessed 10 April 2015)

Part of the problem in understanding offset is the absence of a methodology for evaluation. Despite tens of case studies on offset practice, academics still scramble with explanations on how to define and measure offset success. In many cases, economists actually cite each other to highlight the negative impacts of offset, but seldom conduct real research with credible research methodology.[12] The absence of this is allegedly responsible for the perpetuation of misunderstandings on offset. There is a danger that the problems with offset have been air-brushed out for a number of political reasons that justify more spending on arms procurement.[13]

The aim of this chapter is to remove confusion surrounding offset, by way of examining its conceptual, policy, and empirical elements. In order to do this, the chapter, *firstly*, attempts to construct a definition of offset and to locate its origins in the economic literature. *Secondly*, it seeks to scrutinise the practical side of offset that moulds its operational definition by way of identifying offset's strategic objectives, classifying offset strategies, and describing the implementation of offsets. *Thirdly*, the chapter will discuss the most controversial aspects of offset: whether it works and at what cost, by taking stock of the methods of offset evaluation and the success discriminators. All of this will be based on the existing literature and the researcher's observation of offset policy debates, particularly in Indonesia.

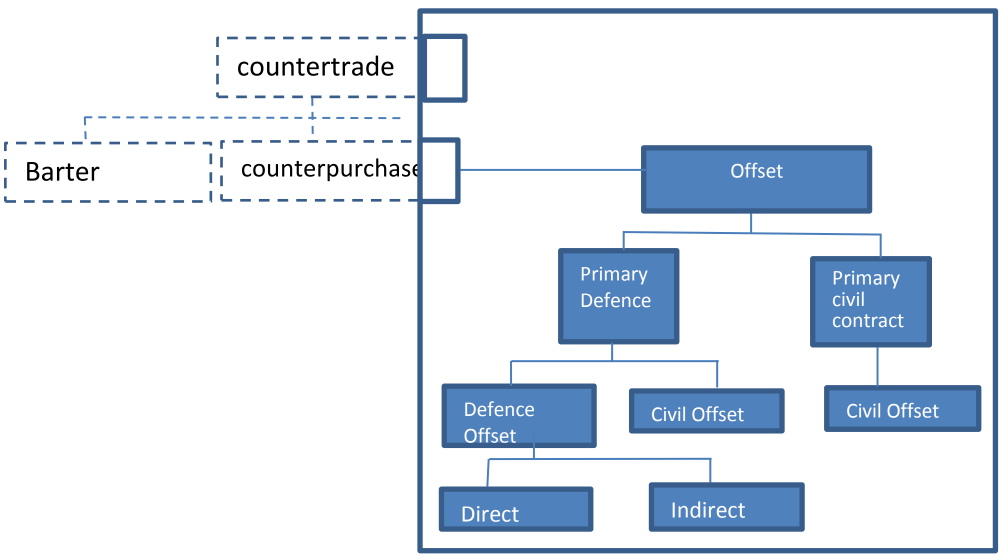
3.2 Definition of Offset

Around 130 countries practise offset today[14], yet as a theoretical construct it is far from being solid. A variety of arguments have been offered as to why offset, as a form of compensatory trade mechanism, exists rather than adherence to classical economic principles. Among the proposed economic theories are second best theory, information asymmetry, rent seeking in public procurement, and strategic trade policy.[15] Most literature begin the discussion on the origins of offset by describing offset as part of countertrade, quite the opposite of the definition of offset offered by WTO GPA that includes countertrade practice. The first part of the subchapter will screen the debate and what transpires in the practice, with emphasis on flexibility of the offset concept as interpreted by the stakeholders.

3.2.1 Offset and Countertrade

Discussion on offset usually begins with its relation to countertrade, a more established concept in the area of trade. Martin suggests that the reciprocity trade framework reflecting offset has been known in the civil sector as 'countertrade', which consists of arrangements like barter (simultaneous exchange of one product for another), clearing agreements (government-to-government transactions through a series of barter exchanges that are consolidated), counter purchase, as well as buy back.[16] He categorises countertrade as part of offset activity and suggests that those who seek to understand offset should also look at the literature on countertrade. Contrary to Martin, Udis argues that it is misleading to liken the reciprocity of offset transaction to barter.[17] Indeed the concept of 'added reciprocity' is central in offset practice, but the objective is not to avoid the use of cash as in barter, but to create added impact or effect beyond the exchange of goods *per se*. Although cash substitution is not central in offset, it is admittedly being used for foreign exchange-related motives. Defence purchase, especially pertaining to big-ticket items purchase, is considered as a disruption to a government's balance-of-payment. Offset serves to improve this condition. Figure 3.1. below describes typology of countertrade according to Matthews, who differentiate offset from other forms of countertrade, namely barter and counterpurchase, and divide it into defence and civil contract.

Figure 3.1 Typology of Countertrade



Source: Matthews, R (2002) 'Saudi Arabia: Defence Offset and Development', in: Arming the South. Brauer, J. and Dunne, J. P. (eds.) *Arms Trade and Economic Development: Theory, Policy, and Cases in Arms Trade Offsets*. Routledge, pp. 92-104.

In the context of defence procurement, offsets can be defined as

> "Compensatory procurement arrangements designed to offsets 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"18

What prompted offset in defence procurement? The notion of 'added reciprocity' and 'added value' in offset signifies several issues specifically related to the arms market. Information asymmetry in the arms market creates the feeling that the vendor could enjoy abnormal profit, which can be remedied by demanding compensation. Furthermore, reciprocity serves as a mechanism to guarantee the quality of goods and service in oligopolistic markets.

Martin lists some theoretical justification for offset, such as it being a policy to achieve second best outcomes. The technology market is characterised by oligopolistic distortions, which could be cited as a justification to use industrial policy. Second, offset as a technology policy, that is government intervention to ensure technology transfer, can be justified on the basis that it promotes economic growth. Third, offset as an industrial tool, supporting infant industry with learning and scale economies through displacement of work from foreign vendors is necessary to achieve competitiveness.

3.2.2 Offset: A Government Policy Instrument and an Industry Marketing Tool

An official definition is provided by the US BIS, which represents the point of view of the US government:

> " Offset is…a range of industrial and commercial compensation practices required as a condition of the purchase of US defence articles and/or defence services".19

Martin cites this definition in his book, arguing the validity of the definition comes from the fact that the US Office of Management and Budget (OMB) has conducted more work on offset than any other organisation, exclusively due to the high number of US arms exports. Whereas Hall and Markowski offer another definition that is more or less similar to US BIS, that is:

> "…A compensatory procurement arrangements designed to offset the cause of purchasing defence equipment from overseas by means of reciprocal (countertrade) commitment by suppliers in support of purchaser's domestic economy."(Markowski and hall, 2005)20

Both definitions underline the fact that offset is a compensatory and reciprocal arrangement linked to a defence purchase. Another definition offered by Udis and Markus (1991) strengthen this argument:

> "… A contract imposing performance conditions on the seller of a good service so that the purchasing government can recoup, or offset, some of its investment. In some way, reciprocity beyond that associated with normal market exchange of goods and services is involved."21

This definition clearly illuminates the fact that offset is beyond normal market exchange, serving as a compensatory arrangement to force reciprocity in trade.

One aspect that stands out about the offset debate is whether it is, or rather should be, mandatory or voluntary. Hall and Markowski (1994) explained that offset is different from normal transactional reciprocity in commercial deals because

> "It may be mandated by governments who apply to either all government imports or, most commonly, to imports of defence equipment above certain value (main capital acquisition) contracted by the DPA." 22

Therefore offset is indeed mandatory, as and when regulated by the government. It is clearly intended as a form of government intervention. However, to define offset as mandatory has its disadvantages. Hall and Markowski notethat mandatory offset policies are inefficient due to their restrictions on the buyer's flexibility in negotiating the most advantageous price-content-quality deals. However, there is more than just a mandatory notion in offset definition. An interesting definition was offered by Eriksson, et.al (2007), which is quite contradictory tothe previously-mentioned definitions that emphasise the mandatory nature of offset:

> "Offset is…Compensations offered by a seller to a buyer. It is applied for so-called off-the-shelf procurement, i.e. for already developed systems."23

Such a definition represents an argument that despite the mandatory nature of offset, it is actually accepted as part of 'rules of the game' and therefore the purchaser no longer has to demand it, instead, it can be proposed actively by the seller. Indeed, in some cases the seller seizes the upper hand by being allowed to negotiate directly with firms in the buyer country and not with its government, or the seller is given flexibility to discharge offset obligations by choosing the type of activities and suitable local partners. For example, India allows foreign suppliers to propose the kind of offset to discharge, subject to governmental approval.

The definition offered by Eriksson also illuminates the fact that offset can only be given in an off-the-shelf purchase; in other words, mature technology. Looking at offset in this way gives the idea that anything related to the 'transfer of technology' in offset must only be dealing with mature technology. In reality, such an interpretation can be misleading because offset can also comprise activities that reach out beyond the purchase, which includes joint research and development of new technology. The research and development of new technology, however, may not be connected to the technology purchased.

The other element of offset is that it does not take place in any defence equipment purchase; it could takes place in international export transactions. Mower defined offset as

> "A provision in an international export transaction that commits the seller firm to provide technology, to procure locally produces components, or to provide other forms of technical and other assistance to firms in the purchaser nation that go beyond those deemed economically necessary to support the sale."24

Taylor argued that the fact that offset is attached to an international procurement is what makes it different from other government policies.[25] Because it is attached to government procurement policies, offset binds at least two actors: at one point is a 'seller firm' and at another there is a 'purchaser nation'. While the supply side could be represented by a mere firm, a government must represent the receiving end. Martin and Hartley offered another offset definition, which also acknowledges the role of firms in the buyer countries in offset negotiation:

> "An offset occurs when the supplier places work to an agreed value with firms in the buying country, over and above what it would have bought in the absence of the offset… usually designed to achieve a relocation of economic activity from the country of the equipment supplier to the purchasing nation" 26

The abovementioned definitions strengthen the idea of offset as a 'burden' on the side of the seller that has to be borne as consequence of an arms sale. Offset puts the seller into a marginal position because it has to deal with a government at the other side of the table. The definition also emphasises the bitter fact that the value of offset is beyond what is economically acceptable to support a sale, thus putting the seller into a disadvantaged position even though it managed to secure the arms sale.Furthermore, Nackmanoffered a definition of offset from the point of view of industry:

> "Defence countertrade is a label for a variety of industrial compensation arrangements utilised by some governments as requirement for foreign defence firms in large procurements. They function as a condition of the sale of defence articles to the purchasing foreign government, whereby that foreign government or its economy recoups some portion of the acquisition's value."27

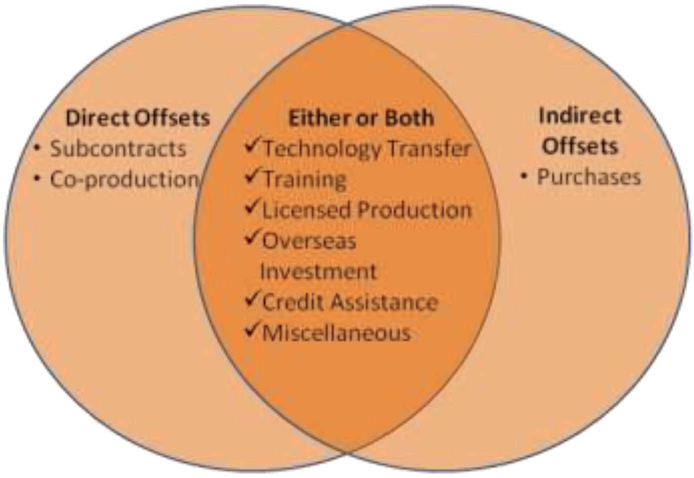
By defining offset as 'condition of sale', Nackman acknowledged the importance of offset for the industry to secure a procurement contract. However, by mentioning 'large procurements', he hinted that offset could only be welcomed by industry if the scaleof procurement is large. This of course a relative concept, and in the international arms market laden with competitors competing for small numbers of potential buyers, how big should the procurement be in order to justify the demand for offset? Countries apparently understand the significant of this relativity; hence, most have set a threshold on a minimal procurement value before they demand offset.

3.2.3 Direct and Indirect Offset

Defining offset gets problematic when it comes to the range of activities that can be put under the offset label (Figure 3.2 and table 3.2). The US government's definition of offset explains that activities required under the offset clause could be related or unrelated to the defence article purchases in the contract:

> "Offsets are industrial compensation practices required as a condition of purchase in either government-to-government or commercial sales of defence articles and/or defense services as specified in the International Traffic Arms Regulations. In defence trade, offset include mandatory co-production, licensed production, subcontractor production, technology transfer, countertrade, and foreign investment. Offsets may be direct, indirect, or a combination of both. Direct offsets refer to compensation such as co-production or subcontracting, directly' related to the system being exported. Indirect offsets apply to compensation unrelated to the export item, such as foreign investment or countertrade."

Figure 3.2 Classifications of Offset Transaction Categories



Source: BIS Offset Database. In: Nackman, M.J. (2011) 'A Critical Examination of Offsets in International Defense Procurements: Policy Options for the United States',*Public Contract Law Journal*, 40(2), p. 519

Table 3.2 Direct and Indirect Offset

Direct offset	Indirect offset
▪ Subcontractor production: overseas production of a part or component of a US origin defense article. The subcontract does not necessarily involve license of technical information and is usually a direct commercial arrangement between the defense prime contractor and a foreign producer. ▪ Co-production: overseas production based upon government-to-government agreement that permits a foreign government of producer(s) to acquire the technical information to manufacture all or part of a US-origin defense article. Co-production includes government-to-government licensed-production, but excludes license-production based upon direct commercial arrangements by US manufactures.	▪ Purchases: procurement of off-the-shelf items from the offset recipient. Often, but not always, purchases are indirect by nature. Indirect purchases are similar in definition to countertrade, while direct purchases are analogous to buy-backs. ▪ 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 defense prime contractor and a foreign entity. ▪ Training: generally includes training related to the production or maintenance of the exported defense item. Training may be required in unrelated areas, such as computer training, foreign language skills, or engineering capabilities. ▪ License-production: overseas production of a US-origin defense article based upon transfer of technical information under direct commercial arrangements between a US manufacturer and a foreign government or producer. ▪ Overseas investment: investment arising from the offset agreement, taking form of capital invested to establish or expand a subsidiary or joint venture in the foreign country. ▪ Credit assistance: includes direct loans, brokered loans, loan guarantees, assistance in achieving favourable payment terms, credit extension, and lower interest rates. ▪ Purchases: procurement of off-the-shelf items from the offset recipient. Often, but not always, purchases are indirect by nature. Indirect purchases are similar in definition to countertrade, while direct purchases are analogous to buy-backs.

Source: nn. (2007). 'Offsets in Defence Trade'.*Eleventh Report to Congress*, US Department of Commerce Bureau of Industry and Security, January 2007.

BIS classifies offset into direct and indirect offset depending on whether the activities are related to the purchased goods or services. The activities are then classified into various categories that describe the nature of the arrangement or exchange.

To explain the extent of variety in offset activities, Markowski and Hallsaid that offset is:

> "….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'28

Indeed some of the activities demanded by the buyer country to be put under offset could bear no relation whatsoever with the purchase. Markowski and Hallilluminate the dark side of offset: a government can actually put in just about anything as and when they label it as offset.[29] To avoid counterproductive results, some governments have come with a clear idea on what activities could be labelled as offset. Matthews provides an example of offset practicethat the British and Australian government used to do in the past. They demand that a programme has to meet some criteria in order to be labelled offset, primarily these are value adding activities like bringing in new technology and skills, and creating new employment.[30] These conditionality and additionality aspects of offset will be discussed further in a later subchapter.

Understanding the expanding definition of offset is also required at the multilateral level. The World Trade Organisation (WTO) uses offset as an umbrella term that encompasses, among others, countertrade. Article XVI of the WTO Agreement on Government Procurement (GPA) refers to offsets as:

> "… Measures used to encourage local development or improve the balance of payments accounts by using means of domestic content, licensing of technology, technology requirement, and countertrade or similar requirement."31

The WTO definition reflects that offset has become a bigger concept than countertrade as it could mean *any* benefit that countries choose to attach to a procurement contract.

To sum up, the operational definition of offset should contain the following key elements: government policy, reciprocity, mandatory, compensation, international trade, mature technology, foreign seller, and domestic industry. Offset is a form of government policy that mandates reciprocity in international trade in arms technology in the form of a compensation from the foreign seller to the domestic industry. In this case, offset is not perceived as a subset of countertrade, but the other way around. The emphasis given in such a definition is that offset is a very flexible concept, determined by both government and the foreign vendor, in order to generate value added on top of what each other will receive and pay in the procurement contract.

3.3 Offset Strategic Objectives

Offset has been acknowledged as a policy tool that can cater for many objectives. Many analysts have attempted to identify the objectives and the motives. Martin explains that offset objectives could link to defence, development, as well as politics.[32] Markowski finds that offset objectives actually correlate with a country's development status.[33] Yang and Wangcategorise an offset objectives typology based on regions.[34] The lists could go on and on, but the basic idea is that offset has become a convenient way to extract rent and achieve multiple objectives.[35] Because offset involves two parties, buyer and seller (in some cases a third party like subcontractor if the prime contractor and offset consultant might also be involved), each party has interests that are not necessarily compatible with the other. Therefore, the strategic objectives of each side will be explored, how incompatible they are, and how offset could and should be used for the benefit of all parties. A mutual understanding that offset can benefit both arms sellers and buyers is believed to be an important precondition for successful implementation.

3.3.1 Objectives of Buyer Countries

The offset objectives in arms procurement have become more diversified in terms of politics and economy. While early offset practice was primary used to countering balance of payments problems between the US and its allies, offset in post Cold War era was used to provide political justification for defence imports and efforts to protect the national defence industrial base, jobs, and technology.[36] Europe used offset throughout 1960s-1970s for, among other aims, of economising scarce foreign exchange to protect a nation's balance-of-payments[37]. Furthermore, such methods are also expected to promote non-traditional goods and to penetrate non-traditional markets. The considerations for a trade surplus in offset are twofold: *first*, the purchasing country does not have significant defence industry hence considers direct offset as unfit; *second*, the purchasing country is in the middle of economic issues, such as a slowdown in growth, and therefore seeks a quick recovery through commodity trading and export diversification.[38] Later on, countries identifyoffset as a mechanism for technology transfer. Udis and Markussuggest that offset might be a more efficient way of acquiring technology than a straightforward purchase, because the risk of the technology failure is shifted to the vendor who will have a greater incentive to transfer successfully the technology for fear that failure will tarnish his reputation in the provision of the entire system.[39] Matthews suggests that offset has been conceptualised as a catalyst for deeper industrialisation, a tool to avoid 'reinventing the wheel' of the R&D cycle, and as a partnering mechanism for engaging in collaborative development of frontier technological systems.[40]

A number of studies have tried to reveal patterns behind offset objectives. For example, Markowski argues that offsets are tiered according to the level of a country's development status.[41] While developed countries (such as Switzerland, the Netherlands, UK and Germany) were able to demand and link offsets to their own military industries (direct offsets), the so-called NICs tend to integrate offset more into non-military industries which explain the preference for a combination of direct and indirect offsets. Lastly, LDCs aim at indirect offset in line with their focus on development. Yang and Wanguse the BIS database to create a typology of offset objectives based on region, namely Europe, Asia, Middle East, and North and South America.[42] Countries that came from the same region were claimed to have similar objectives, such as Pacific Rim countries who sought to use offset for aerospace technology transfer while country from North and South America focused on economy, technology, and jobs. This argument seems to be in correspondence with Markowski's. In this context, a region as a category could actually represent a group of countries with similar endowments and stage of economic development. For example countries from the Middle East such as Saudi Arabia and the United Arab Emirates are similar in their reliance on oil production, hence they share similar offset objective to diversify their economy portfolio. Apart from these presumed trends, offset objectives indeed encompass broad objectives with economic, political, and strategic/defence considerations. With careful planning these objectives can be synchronised, but they are in fact inherently different and entail clashes of interest.

Defence offset can be used to develop indigenous capability to 'produce' a comprehensive range of weapon systems in a country; in other words, defence industrialisation. Development of a defence industry is characterised by costly entry, rapid technical progress, and small demand, hence firms often survive by relying on government orders, and subsidies.[43] Subsequent to government support to overcome the high cost of entry, offset is used to help provide learning and scale economies by forcing the foreign firms to transfer work to domestic manufacture. [44] As Martin suggests, the volume of work relocated might be such that domestic industry becomes internationally competitive, moves up the learning curve and, once, established, has no need for further protection.[45] Other related motives are wide-ranging, such as regional ambitions (India, Brazil, Indonesia), creating maintenance capacity, repair and overhaul (MRO) as well as upgrading capability (Singapore), reviving collapsed industry (Poland), and leveraging positions to fit into global supply chains (Australia, Canada).[46] Offset for defence industrialisation develops over time, to help countries climb the ladder of production. For example, during 1960s-1970s Singapore's procurement of M16 rifles helped develop domestic capability to produce the indigenous SAE 80 weapon. Also, Malaysia's procurement of Russian MiG fighters in the 1990s helped to establish domestic capability in the aerospace maintenance and repair service.

Those states with no interest in promoting a defence industrial base *per se* could put defence offset to better use, such as to promote development objectives. According to Hammond, there are 13 economic objectives, among which are increasing local employment, enhancing market penetration, transfer of technology and increased diversification.[47] Markusen suggests that countries foresee relative stagnation in the international military market and choose to use their offset credits to construct new comparative advantages in sectors with greater income elasticity and growth potential.[48]

Saudi Arabia uses offset to reduce dependency on oil exports through development of a downstream petro-chemical industry.[49] The reason behind such a policy seems to be self-assurance that off-the-shelf weapons are readily available anytime.[50]Also, the country acknowledges that having a small and unskilled population does not fit with defence industrialisation ambitions; hence it should focus on production of non-military items that can serve both a civil and military purpose. Offset, in this regard, is used as an extension of long-term civil programmes of technology transfer under contracts in the military sector.[51] In the case of the Al Yamamah programme in which Saudi Arabia purchased fighter jets, training jet, naval ships and other equipment from the United Kingdom, the Saudi British Economic Offset Programme was formed in 1989 to manage offset programmes to reach a value of more than 1 billion pounds sterling. Offset has proven to be instrumental in establishing joint ventures in the chemicals, polypropylene, sugar, logistics and other sectors. For example, one of the established programmes was the joint venture between Tate & lyle, Savola Group and other Saudi Partners in constructing a sugar refinery worth 100 mn pounds sterling. It is held that the refinery will fulfil nearly 100 percent of domestic demand, with possible export potential.[52]

Other examples of the use of offset for development purposes arethe United Arab Emirates, Canada, the Netherlands, Denmark, and Finland. In United Arab Emirates, offset objectives included the aim to diversify the economy through the transfer of technology, gaining overseas market access, and creating job opportunities for its nationals. In Canada, offset has been used as regional development policy by spreading offset work.[53] Whereas in the Netherlands, Denmark, and Finland, offset is used to enhance the development of strong domestic small medium enterprises (SMEs).[54]

Employment generation is an offset objectives in many countries, such as Israel, Czech, Saudi Arabia, South Africa, as well as the United Arab Emirates.[55] The driver behind this is both political and development related. First, offset serves as a compensation for the loss of manufacturing opportunities and jobs incurred by the purchasing country's economy when big value procurement is given to foreign suppliers. In countries where government procurement becomes a politically sensitive issue, employment serves as a substantial justification for a foreign purchase. Second, offset becomes a government intervention policy tool in the labour market, creating demand for specialised employment in leading edge technology sectors that otherwise would have been absent. This can be done by, for instance, encouraging foreign firms to buy more from local industry and specific policies to promote regional distribution of offset work to encourage firms to locate economic activity in specific geographical areas.[56]

Political economic motives for particular offset objectives exist in Israel, which faced an immediate challenge to providing jobs for immigrants flowing into its territory. For example, from late 1986 through 1996 the migrant inflow from Russia increased the total Israeli population by 11 percent and the labour force by 14 percent.[57] For the Czech Republic, which has been using offset policy since 1998, employment generation is critical to address the dramatic decline in employment in the traditional industrial regions.[58] Political and economic changes due to the separation from the former Czechoslovakia have caused transformation in the economy, leading to the disappearance of large heavy industries to be replaced by SMEs, and the balancing of development across regions. Saudi Arabia and the UAE have faced similar challenges. In Saudi, the problem of unemployment is the utmost urgency due to high population growth and the majority of the population being under the age of 30 years.[59] The UAE is faced by the twin demographic challenges of a young population in need of meaningful employment and a strong reliance on foreign labour whereby 20 percent of UAE nationals were under the age of 15 in 2008 and 73.9 percent of those of working age are non-nationals.[60] South Africa determined job creation to be one of the offset success indicators when agreeing to the Strategic Defence Packages in 1999.[61]

The Dual-use Objective

Bitzinger argues that offset in earlier times was simply used to quicken the process of defence industrialisation, but along the way it has been transformed into a more complex set of objectives and partially moved away from defence *per se*.[62] Offset objectives have broadened from defence to dual-use and non-defence purposes. South Africa, for example, used direct and indirect offset simultaneously to facilitate a set of objectives that included retaining a sustainable defence industrial capacity. Its government also attempted to use arms purchases to leverage substantial investment in non-defence sectors by directing it to particular sectors like minerals and energy.[63] The Malaysia Vision 2020 policy published in 1991 implicitly recognises the potential for spin-off from defence offset to support the plan for economic take-off: shifting from labour-intensive industrial development to high technology sectors, particularly aerospace.[64] It is worth pointing out that this mixed policy might have stemmed from the inability of defence industry to absorb overall offset programmes, hence the need for indirect offset. The challenge of this approach is the complexity of offset contracts and the loss of focus, because a variety of activities that have no connection with each other along the spectrum of direct-indirect offset have to be managed within a limited period of time.

The defence industrial base can also be used as a lever for broader economic development, using spin-off as one of the determinant success factors.[65] Singapore, with MILEX per GDP as high as 6%, used offset pragmatically to develop the capability of maintaining and supplying, upgrading, and modifying imported weapon systems, particularly aircraft. Singapore leveraged its military purchases to gain the expertise it needed to become a major partner in international aircraft development and upgrade programmes.[66] Later on, Singapore used its offset efforts to commercialise and globalise its arms industry with considerable success.

3.3.2 Objectives of Seller Countries

Industries have accepted the importance of offsets as a *sine qua non* for securing arms sales. When a buyer starts to demand compensation for securing an arms deal, suppliers would prefer to conform rather than losing what would be a high-value but scarce sales opportunity. In some cases, offsets values can reach extremely high figures that exceed the value of the arms deal contract, such as in 1999when the South African government received offset offer worth R104 billion under Strategic Defence Packages, more than three times the value of the arms deal.[67]

However, while offset could be beneficial for the foreign vendor's competitiveness, the impact could hurt domestic industry. An example of this is Martin Marietta's agreement to buy optical gear abroad as condition forarms sales, leaving it to find new vendors for electronics and electro-optic displays in Germany and Israel.[68] Martin Marietta was not aware of the negative impacts of its actions on the US optics industry. Furthermore, offset - especially the indirect variant - is not exactly the area in which the supplier excels. To turnaround this marketing landmine, prime contractors often delegate the implementation of offset obligations to its subcontractors. When General Dynamics secured the sale of F-16s to European countries in 1977, it required Menasco – a supplier of its landing gears - to teach a Dutch company called DAF how to make the gears.[69] As a consequence of this sale, General Dynamics secured significant income while Menasco had to deal with self-made competitors in the international market.[70]

According to Hammond,there are ways in which suppliers can benefit from offset.[71] First, offset is a tool to secure competitive advantage in the highly competitive international market. Sellers could also use offset to enhance market penetration, by allowing a company to establish a commercial position it would have been unable to obtain in any other way. Offset provides an opportunity to sharpen marketing capabilities and increase networking and contacts to handle a wide range of unrelated products. Offset also provides ways to avoid financial and legal complications, because tariffs and quotas are usually waived and exempted from offset agreements.[72] In short, offset has been used as tool of trade by the supplier. Martin and Hartley suggest that another benefit offset may present to the industry is the discovery of new lower cost suppliers, with whom they can continue to do business after the offsets deal is completely discharged.[73]

3.3.3 Compatible or Contrasting Objectives?

It can be said that the objectives of supplier and buyer countries are compatible in the beginning of their offset relationship, when politics is more prominent than economic motives. It was security interests that prompted the US to enter into offset arrangements with its closest allies, NATO, Japan, Australia, and New Zealand.[74] When offset is taken beyond the initial objective, such as to help economic development of the buyer country, it presents ever-growing challenges to the supplier and buyer. Bear in mind that offset stakeholders are not limited to foreign vendors and national firms, but also the host government and armed forces that also need to be taken into consideration. Armed forces as users has theirown interests, among which is to minimise life-cycle costs and delivery risks. Offset can be seen as a threat to this interest; for example, direct offset could add the risk of cost-bloating under performance and late delivery. On the other hand, the government might have broader interests, such as to attract investment, create jobs, and minimise procurement costs. This shows that not only competition of interests exists between foreign and domestic stakeholders, but also among the latter.

The main philosophy of a firm is to sell as much of its product while keeping the cost of business low. To engage in offset incurs a cost premium, that depending on the arrangement could end up being borne by the supplier thus supressing marginal profit. While defence firms are eager to score rare and high value deals using offset as a deal sweetener, the effect of offsets on industry's competitiveness and employment has been alarming.[75] Furthermore, the fact that offset is widely practised means that suppliers will face offset demands from different countries that might share similar objectives. As offset providers tend to transfer business to another country where it has an outstanding or new commitment, sustaining offset benefits could be a challenge for the buyer country.

3.4 Operationalisation of Offset

3.4.1 Classification of Offset Strategies

The national offset strategy policy varies, stretching from flexible to mandatory approaches, as shown by Figure 3.3.

Matthews categorised offset policies based on their place in the mandatory case-by-case pendulum. The first category is case-by-case, which aims to maximise mutual benefit through negotiation and compromise.[76] This discretionary approach is used only when the buyer foresees the benefit of using an offset strategy. The strong point about this approach lies in its adaptability to the complexity of acquisition technology, contract negotiation and compromise (Khan, 2010).[77] Having said that, the success of this approach relies on the people who determine and negotiate offset. Hence, this approach only fits with a country where a pool of experienced people exists to operate the offset already in place. The prominent examples of countries using this approach are Japan, Singapore and Italy.

Figure 3.3 Spectrum of offset policy possibilities

Case-by-case	Best endeavour	Obligatory
• Dependent on mutual requirements, e.g. Japan, Singapore, Italy	• Based on partnerships and trust, e.g. UK, Saudi Arabia (Al Yamamah)	• Prescriptive, with requirement targets, e.g. Saudi Arabia, South Korea, Norway, The Netherlands, United Arab Emirates, Malaysia, etc.

Source: Matthews, R. (2005), 'Defence Offsets: policy versus pragmatism' in: Brauer, J. and Dunne, J. P. (eds.) *Arms Trade and Economic Development: Theory, Policy, and Cases in Arms Trade Offsets*. Routledge. Example of countries are added with author's permission.

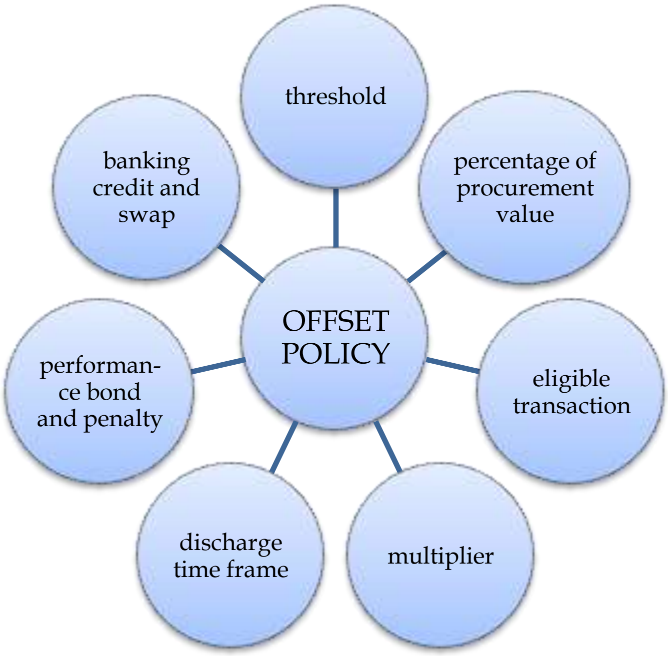
The second approach is mandatory policy, which is opposite to the case-by-case policy. The mandatory approach relies on formal policy, which prescribes in detail the minimum value of the procurement contract in which offset becomes an obligation, the offset threshold as a percentage of the main contract value, multipliers, as well as penalties. This is the normal approach chosen by a country where the available staffs lacks experience and skills in dealing with offset agreements, but it comes with the disadvantage of inflexibility resulting from the imposition of a standard solution.[78] Matthewsnotes that the prescribed policy has become more and more ambitious, which has led to policy stress and non-fulfilment of supplier's offset commitments.[79] The examples of countries using this approach are many; among them are South Korea, Norway and Saudi Arabia. The first and second approaches are not mutually exclusive. In the case of South Korea, a mandatory offset policy is accompanied by flexible articles that adopt the discretionary case-by-case approach.

The third approach is best endeavours as was practised by the UK and Australia. This approach relies on partnership, trust, and supplier commitment; hence apply no penalty in a general sense. However, the offset discharge performance of a supplier will be factored into future procurement bids in the form of disbarment. The fact that the UK came out as the biggest offset receiver throughout 1993-2006, in the absence of a written policy, indicates the success of its non-mandatory approach to offset.[80] However, a best endeavours approach is also tricky and may not work in some countries. Australia, for example, once discarded this approach for mandatory approach in 1986. Australian offset policy initially relied on a best endeavours strategy (1970-1986) but then changed to a mandatory approach (1986-1992), before returning again to a best endeavours strategy (1992-).[81] The mandatory offset was replaced in 1992 by more focused provisions within the contract, which put defence offset only as a 'last resort'. A new offset policy in 2008 strengthened the non-mandatory approach of Australian offset implementation, which was then followed by the 2009 policy innovation emphasising access to global supply chains. Under this policy, industrial participation in foreign arms procurement is directed at meeting the objective of creating opportunities for capable local firms to compete for work in the global supply chains of multinational primes and their major suppliers. The Australian case shows the possibility of an offset policy approach to evolve as countries learn more about what does not work in offset.

3.4.2 Offset Policy Features

Features that are normally included in offset policy - whether it is mandatory, case by case, or best endeavours - are a minimum value of procurement contract where offset becomes applicable, an offset threshold, eligible transaction to be recognised as offset, multipliers, discharge time frames, performance bonds and penalties, offset banking credits and offset swaps. All the main features of offset policy are captured in figure 3.4. below. These are policy tools to ensure that the purchasing country can gain optimal benefits from offsets, by allowing the foreign companies to discharge their offset obligation within a predetermined time frame and, if possible, at no cost to the offset receiver.

Figure 3.4 The main features of offset policy



Source: Author

Threshold

One of the basic questions raised in formulating an offset policy is whether offset can be applied on a mandatory basis over government procurement with small values. This question is relevant particularly to small defence economies whose arms procurement is small, in terms of contract values and scale/volume of arms, compared to medium or big defence economies. Evidence suggests that the value and scale of procurement contracts affects the negotiating position of a buyer country: the bigger the purchase, the better the negotiating position. For example, when Turkey bought 160 F-16s through Foreign Military Sales (FMS) in 1983, the offset was to build 152 aircraft locally, where around 70 percent of the airframe was manufactured by Turkish Aerospace Industries (TAI).[82]When Indonesia bought 12 F-16 in the 1990s, the accompanying offset was 'only' to build locally six subcomponents equal to 30 per cent procurement contract value.[83]

In mandatory cases, offset usually applies on a pre-determined threshold of procurement value. The lowest threshold so far, was applied by Brazil at a procurement value of USD 1 million and Slovenia at a procurement value of EUR 400,000. Taiwan, Denmark, Israel, Malaysia determine offset minimum thresholds at a procurement value of USD 5 million, while Italy, Norway, Netherland, Poland set the bar at EURO 5 million. Norway approaches thresholds by targeting not only a single procurement contract but also aggregate contracts won by a single supplier. Suppliers to the Norwegian Armed Forces which during a five year period may be awarded multiple contracts, separately not exceeding the threshold value, areobliged to sign a conditional framework Industrial Co-operation Agreement if the aggregate contract value exceeds the threshold value.[84] Once the aggregate value of procurement hits the threshold, the Agreement becomes effective: all subsequent contracts concerning the same supplier are subject to offset regardless of its value.

The highest offset thresholds are applied by India and Canada, which determine offset minimum thresholds at procurement values of USD 64.9 million and CAD 100 millionrespectively. Minimum thresholds are not permanent and are subject to revision. Turkey used to apply offset at a minimum threshold of USD 5million, then the 2007 industrial participation and offset directive revised the threshold and doubled the value to USD 10 million, lifting the threshold up to the level of the United Arab Emirates and South Korea.

Relatively high thresholds could mean many things: first, only high value arms procurement requires offset. The logic behind this is that high value procurement is akin to high technology value as well as large production scale. Second, only the big defence companies are targeted for offset. On the other hand, low thresholds could also mean that small and medium enterprises along with not so high technology firms are also subjected to offset. Since it is not very clear as to why a country determines an offset threshold at certain contract values, the use of a threshold could also mean limiting the number of procurements to be subjected to offset for the purpose of practicality.

Thresholds might just be used to constrain the number of offset programmes, because applying a blanket-offset policy across all procurement is impractical and requires massive resources. Those with a case-by-case or best endeavours approach to offset use thresholds. For example, Italy applied an offset threshold of 5 mn euro.

When offset is negotiated on a case-by-case basis, the threshold might or might not be used. If it were to be used, the application is based on a buyer country's technological needs rather than the value of the procurement contract. For example, although the minimum threshold in South Korea is US$ 10 mn, offset can still be pursued on a case by case basis made by DAPA's policy for contracts with a value less than US$10 mn. South Korea realises that although the threshold has been determined based on standard criteria, it does not always offer the country the optimal technology and industrial benefits.

Offset as a Percentage of Procurement Value

In the beginning of offset practices in the 1950s the purchasing country only sought offset up to 10-30 percent of the value of a procurement contract, but by 1982 the threshold had gone up to 100 percent - the first of which occurred in the F-18 purchase by Canada.[85] Offset is usually defined as a certain percentage of contract value. Halldivides the offset requirement into equal thirds: high, mid-range, and low.[86] High offset requirements mean that the offset demanded is at least 100 percent of the procurement contract value. An example of this is Brazil, which applies a 100 percent offset - occasionally rising to 120 percent. Mid-range offset equals 50–99 percent of procurement contract value. Low threshold refers to offset demand at lower than 50 percent of procurement contract value, such as in the case of India.

Why countries have different offset percentages of procurement contract is intriguing. India, for example, decides to keep its offset percentage at 30 percent in general, but in individual cases this can rise. Verma suggests that many factors affect the decision on increasing offset thresholds: strategic importance of the acquisition or technology, the enhanced ability of the national defence industry to absorb the offset, the export potential generated, the negotiating position of the buyer country in the world defence market, the perceived need for direct/indirect offsets, and the capabilities of domestic industry to absorb the technology and participate in the quantum mandated in the discharge of obligations .[87]

Verma's factors affecting offset threshold decisions explain the reasoning behind the buyer's side, which can sometimes make no sense. For example, if the offset value equals the value of the main procurement contract, how can the supplier make the sale profitable? The issue becomes more complicated when the offset demanded falls within production related direct offset. Considering the cost structure of defence industry, in which the prime supplier or lead integrator do not own the whole value chains for defence production, it would be impossible for the supplier to give offset value equal to the procurement value. In the case of direct offset, one hundred percent offset may mean the company has to give up all of its profit.

As and when 100 percent offset is demanded in direct offset, there are two possibilities that follow. The first is, knowing beforehand the offset demand, the supplier might increase the price of defence equipment in order to maintain reasonable profit hence creating an 'offset premium cost'. This will be elaborated further in the following subchapter on offset cost. The second is that the prime contractor will distribute the offset obligation across its value chain, which opens the involvement of third parties. An example of the latter is the involvement of Indonesian Aerospace as a subcontractor to the French company Thales in the offset programme linked to Turkey's Meltem II acquisition project.

What if the offset percentage goes beyond the value of work of the main supplier? In the case of Brazil, offset demand can reach up to 120 percent of the procurement contract value, which makes no sense at all. Such high offset values only become understandable when the concept of the multiplier is introduced into the calculation, which means the value of offset, as a percentage of procurement value is not the real value. The multiplier will be elaborated further in the next subchapter.

Multiplier

According to BIS, the multiplier is "a factor applied to the actual value of certain offset transactions to calculate the credit value earned".[88] The multiplier is used as an incentive for a supplier to direct offset activities to sectors that the buyer country feels most beneficial. There are two kinds of multiplier, which are positive and negative multipliers. Positive multipliers are the ones used to attract offset into a designated area, thus applied so that the supplier receives a higher credit value, higher than the offset actual value. For example, the United Arab Emirates gives a multiplier from 2 to 5 based on a spectrum of variables, namely end market, product/services, function, infra-structure, others (skill development, education and knowledge, social benefits within UAE).

Negative multipliers, on the other hand, are used to discourage a supplier to offer offset activity in sectors that are not among the buyer's best interests.[89] One example of negative multipliers is the Switzerland multiplier for offset that falls outside its pre-defined industrial sector, which is 0.5 or equal to half of the value of offset.

Because of the multiplier, one needs to understand that there are two kinds of offsets values: 'actual value' and 'credit value' of the offset transaction. The first refers to the real value of the offset transaction while the latter refers to the value credited for the offset transaction by application of a multiplier, which may be greater than, equal to, or less than the actual value of the offset.

The purpose of applying a multiplier is clear, that is to require suppliers to discharge offset obligations in certain sectors with criteria that depend on, among other things, pre-defined sectors, offset receiver (industry, research institute, and so on), and end-market, product/services. South Korea uses multipliers to encourage offset in aerospace. Switzerland gives the highest multiplier, which is 3 (three), for offset transaction with high relevance to Swiss security and armament policy.[90] India gives the highest multiplier, which is 3.0 (three) for technology that is offered without any restriction and with full and unfettered rights including rights to export.[91] Malaysia, on the other hand, will only consider multipliers in exceptional circumstances, such as when the programme acquired lead to high-end acquisition or maximisation of FDI into Malaysia.[92]

In some countries, private sector firms, especially small and medium enterprises (SMEs) are regarded highly as offset receivers. Canada has been known to use offset to support SMEs. The United Arab Emirates value offsets in the form of developing private infrastructure with multiplier values of 4 (four) while developing public infrastructure is only valued with a multiplier 2 (two), while social benefits for SMEs are valued with a multiplier 5 (five). India gives a multiplier of 1.50 if the offset is directed to SMEs.

Using multipliers has its benefits and disadvantages. On the positive side, a multiplier is useful for the foreign company to formulate an offset proposal based on the type of activities that earn the highest multiplier. This way, the foreign company can come up with an offset proposal that meets the offset value obligation at the smallest cost. The negative side of the multiplier is the complexity that it brings to the offset evaluation. Since the value of technology is subjective, the offset receiver and the provider could have different multiplier calculations due to different judgements.

From the buyer country's perspective, the multiplier is also used to ensure the absorption of offset opportunity by the local industry. This might help to explain the different range of multiplier values across countries. Countries with low technology absorption capability might use a high range of multipliers to claim high offset credit, concealing the reality of its actual value. Here, a multiplier might actually be used for political gain, creating the impression of high benefit and high local absorption, to justify the procurement programme and the accompanying offset.[93]

Apparently, not all countries believe that applying multipliers will endorse the the attainment of offset objective. Not all countries that practice offset use multipliers. The UK, for instance, used to rely on a best endeavours strategy, and did not use multipliers. Instead it allowed the offset provider to propose the value of offset. Another example is Malaysia, which only uses multipliers selectively in special cases.

Eligible Transactions

Determining what can be credited as offset is more challenging in the implementation stage. While government can refer to defence, industry, and technology policy as guidance for determining offset in the policy formulation stage, it might need a set of new criteria to do similar task during the offset implementation period. To avoid confusion and also low-value offset, some countries come up with a set of well-defined criteria to differentiate offset from other trade. According to Taylor (2012), an offset contains elements of additionality and sustainability to set it apart from other trade that occurs naturally.[94] Additionality refers to new economic activity that was transferred from the seller to the purchasing government's economy, above existing activity that may have occurred in the free market. Sustainability refers to the benefits that accrue over a long period. A related term to additionality is conditionality, which refers to reciprocal exchange among multiple firms. Basically conditionality means that a benefit can be considered as offset if it can only be produced by offset. Hence, offset has to provide both additionality and conditionality during offset valuation.

The operationalisation of additionality/causality varies across countries. For example, in Canada the benefits must be brought about from industrial and regional benefit obligations. In Norway, the continuation of an existing business is usually ineligible, but increases in the size of business of product portfolio may be accepted provided that this results in increased business activity or the development of technology and/or production capacity.[95] Another criteria for offset eligibility is high technology. High technology is sought after in offset, but the implementing definition can be tricky. Some countries like Canada and the Netherlands define their technology requirement as “equivalent technological level in relation to the purchase of the defence equipment”.[96] In Switzerland, the value of technology transfer cannot be recognised as offset. Only added value for the Swiss economy actually generated by the technology transfer can be recognised; for example, export transactions of follow-up business with a Swiss enterprise with other foreign enterprises that can be proven to result from the previous technology transfer.[97]

Performance Bond and Penalties

With respect to the fulfilment of offset obligations, the offset provider is required to establish a performance bond. The buyer country withholds a performance bond as a guarantee against the offset obligation discharge, in which any shortfall in discharge will be absorbed by the performance bond. The common practice is that the amount of the guarantee refers to the procurement regulation in the buyer country, unless it is stated otherwise in the offset guidelines. In South Korea, the contractor/offset provider does not have to establish a performance bond for the offset programme separately when the parties agree to use the performance bond of the main contract/procurement contract.[98] Similarly, Canada does not demand the supplier to furnish a performance bond, but will retain at least 10 percent of the purchase payment if an offset obligation is not fulfilled.[99]

The form of performance bond varies. South Korea requires an irrevocable stand-by Letter of Credit that shall be valid until 90 days after the expiration date of the offset performance period. Malaysia requires a performance bond in the form of a bank guarantee from an acceptable Malaysian bank to the value of five percent of the main procurement contract. An additional performance bond can also be requested in the event that the period of offset obligation discharge exceeds the period of the main procurement contract, as in the case of India.[100]

Regardless of the nature of offset requirements, whether it be mandatory, case-by-case, or best endeavours, penalties have been widely applied. The purpose of the penalty is clear: to prevent the supplier from non-performance, and in some cases, barring the non-performing supplier from participating again in future procurement bidding. The United Kingdom that used to implement offset on a best endeavours basis also applies a penalty in the form of debarment, while Singapore implements offsets on a case-by-case basis applying penalties equal to up to 10 percent of the unfulfilled obligation.

Discharge Time Frame

The offset discharge time is regulated in the offset guidelines, which comprise the length of offset discharge, the 'grace period', and the extension. The length of offset discharge is varied, from co-terminus (offset discharge time is similar and runs parallel with the main procurement contract) to non co-terminus. Some countries chose not to use a co-terminus approach and instead, for example, in Italy and Austria, determine a discharge period ranging from 5 to 15 years. The co-terminus offset discharge time has become the most common practice. An example of this is the Malaysian offset guideline, which mandates offset obligations to be fulfilled within the delivery dates of the main procurement contract. However, it does not negate re-negotiation for extensions. Other countries use co-terminus plus a guarantee period as the basis to determine offset discharge time; for example, Turkey applies a procurement contract delivery time plus a two-year guarantee period and

Belgium applies a contract period plus 1-2 years. The benefit of using co-terminus for offset discharge time is that it is difficult to separate offset success from the main procurement, because the main procurement contract cannot be closed if the offset discharge is not yet concluded. Usually this is linked to the penalty system, whereby part of main procurement contract payment will be withheld if the provider can not perform in discharging offset obligations. This way, the provider is forced to carry out its offset obligation more seriously. However, the co-terminus approach is criticised as being too restrictive; for instance, it restricts the sourcing of major assemblies/component in the case of India.[101]

Other countries have different approaches to offset discharge time; for example, using a milestone system. In the case of the UAE, its offset programme is divided into seven milestones across seven years, which requires a certain part of offset work to be finished within each milestone from the smallest (5 percent) to the biggest (25 percent): milestone 1 (5 percent); milestone 2 (10 percent); milestone 3 (10 percent); milestone 4 (15 percent), milestone 5 (15 percent); milestone 6 (20 percent); and milestone 7 (25 percent). The purpose of using milestones is to foresee potential problems at early stage, hence implementation failure resulting in a penalty can be avoided. Sweden and the Netherlands also use milestone systems for the offset implementation time frame. A grace period can also be considered, but excluded from the offset discharge time. In the case of the UAE, the offset authority could determine a grace period as a head-start for the offset provider to set up a project that has complex infrastructure, training or facility requirements, which need additional time for construction or assembly.[102]

Offset Swaps

Offset swap/abatement schemes represent bilateral agreements that involve the reciprocal waiver of all or part of an arms suppliers' offset obligations by the purchasing government and other governments in which the first country has mutual offset obligations. The Netherlands, for example, accepts a swap mechanism that allows mutual abatements. This means that an outstanding offset obligation of the Netherland's industry in a foreign country can be swapped with outstanding offset obligations of the same country in the Netherlands. Switzerland and Turkey stated in their offset guidelines the acceptance of an offset swap practice. In some cases, third party outstanding offset obligations can also be considered.

In addition to a bilateral mechanism, abatements have been encouraged through trilateral and multilateral mechanisms. Denmark, the United Kingdom and the Netherlands have concluded a trilateral memorandum of understanding on offset abatement. The European Defence Agency (EDA) pushed for an offset abatement among member countries through its Code of Conduct on Offset issued in 2009.

3.4.3 Linkage to Defence Procurement: The Offset Life Cycle

Offset is an integral part of the procurement process; it is conducted in parallel with the procurement life cycle. As a consequence, offset could affect the conduct of procurement. First, the offset requirement potentially slows down the procurement process. Second, as a policy, offset might have different objectives compared to procurement; this might add to complexity in negotiation because offset negotiation is also part of procurement contract negotiation. Third, because offset agreement is part of the main procurement contract, it could serve as an additional risk. Unsuccessful direct offset could affect the fulfilment of the procurement contract.

In order to understand how offset operates within the procurement cycle and the risks it creates, this research borrows Yang and Wang's offset life cycle model, which was basically an integration of the offset sequence in the acquisition life cycle.[103] The offset life cycle is divided into four phases. Phase I is the preparation phase where offset players need to evaluate the seller's and the buyer's capabilities, and then develop a strategy. Phase II is the negotiation and decision process. Phase III is the execution and audit phase. Phase IV is termination and feedback. Phase I and II are part of the strategic level view of offset, whereas phase III and IV represent the execution level. There are two evaluations accompanying this cycle, which serves as a sort of milestone for the offset. The first evaluation is conducted after phase I, with the purpose being a device evaluation mechanism with a strategic level view to decide which factors can affect the outcome of offset. The second evaluation is in the middle of phase III, after the execution but before the audit begins, with the objective to evaluate the effectiveness of the offset programme.

Phase I (preparation) is about planning the priorities. It is almost impossible to be done without predetermination of policy guidance as reference for offset priorities. This policy guidance could take the form of a national science and technology policy and armed force R&D policy. The British and Australians have a different view on this. While the British view national S&T policy as a reference to industrial participation, the Australians believe that decisions on offset should follow the armed forces' R&D policy.[104] A full knowledge of technological capability of the national industry as a potential offset receiver is also vital for decision-making on this stage. For example, the government of Malaysia requires an industry database, market intelligence, and a technology database as the basis for decision-making in this phase.[105] No less important is the procurement plan that reflects the potential economies of scale, which serves as an important incentive to the national industry. According to Verma, it is important that industry is involved in the early stage of offset planning and aware of the government procurement plan. This would provide assurance of future business with the government that acts as an incentive for the industry to invest in new capabilities required to absorb offset.[106]

After the government of a buyer country concludes the offset prioritisation, it can issue offset demand around the same time as the Request for Proposal (RfP) as a requirement to participate in the procurement tender. Some countries provide written offset guidance, which includes offset objectives, offset value, as well as multipliers, providing a reference for potential bidders to formulate their best offset proposal. The buyer country could also provide access to a national industry database to assist potential bidders identify and connect with qualified local offset partners.

Phase II (negotiation and decision process) begins with evaluating the proposal from the foreign vendor. Although offset is not meant to be 'the' determining factor in a bid, it could be when traditional indicators like performance and cost in the competing bids come out almost identical. While offset valuation is the imperative at this stage, countries employ different methods and include different variables to determine offset value. Negotiation can be conducted between the purchaser country and the foreign vendor, or between the vendor and its potential partner in the purchaser country. For example, in India, negotiation of the MoU between the bidder and Indian partner is critical, since it is the only document signed by the offset partner before signing the offset programme contract. Foreign bidders will formulate a Technical Offset Offer for the technical bid that contains details of products/services to be contracted, the percentage of offset commitment and the MoU with the Indian offset partner.[107]

Phase III (execution and audit) begins with the implementation of the offset and is accompanied by an evaluation of the efficiency of the offset programme. In order to review the efficiency of the offset project, Wang and Yang suggest using data envelopment analysis, a method to identify input and output data. Input factors refer to how many resources companies need to put into the offset project, which includes manpower, material, and budget. Output factors refer to breakthroughs in critical technology, improvements in quality, reductions in R&D costs and schedules, the development of new products, and improvements in existing products.

Phase IV (termination and feedback) is the last stage in the offset life cycle, when offset evaluation from the previous stage is used as feedback for both the purchasing government and the foreign vendor to set new efficiency criteria for the next offset project. This evaluation can be used to determine whether a foreign vendor will be blacklisted from the next procurement bid if it is considered as failing in offset delivery (disbarment).

3.4.4 Responsibilities of the Offset Authority

The government needs to establish institutional and legislative frameworks for operating offset agreements for two reasons: first, to overcome economic disadvantages associated with offset and, second, to manage the complexity of a long-term commitment.[108] The first reason implies that, as suggested by Brauer, each country needs an arms trade offset audit team to measure the full economic cost of each proposed deal.[109] To determine whether offset choice is more expensive than off-the-shelf or other choices, though, is an uphill task, if not impossible, considering the absence of information to measure the real cost of offset. In India, an independent audit body was created to carry out offset evaluation in an independent manner, arguably eliminating the potential for collusion and corruption. The second reason prompts an important question: does government need a dedicated offset agency to manage offset programmes? The issue was raised owing to the fact that offset implementation is complex and lengthy, akin to the procurement programme.

Whether a dedicated agency is required depends on whether the functions of such a body and competencies are present. Platzgummer suggests there are three primary functions of an offset agency: first, it defines the offset contract with the foreign supplier; second, the agency is responsible for monitoring the implementation of the offset agreement; third, the agency informs companies from the domestic defence industrial base about possible cooperation with the foreign vendor.[110] He concludes that even though offset is rather exceptional, the functions of an offset agency are relatively similar to other government agencies. Therefore, the function of an offset managing body could be handled by an existing government body, such as the Treasury, Ministry of Defence, or a procurement body. In the absence of such institutions, government could decide to create a standalone offset body for the specific purpose of offset implementation.

In practice, the level of institutional arrangement for offset implementation varies due to differences in legislative frameworks. Offset policies are issued as regulations at various levels, such as government regulation (Hungary), ministerial regulation (Malaysia, the Netherlands), procurement agency regulation (South Korea). As a consequence, the level of regulation determines the level and degree of officials in charge with offset policy and implementation. For example, the Malaysian offset policy is issued by the Ministry of Finance, because it covers public procurement across government ministries; hence implementation becomes the responsibility of related ministries, which puts the Ministry of Defence in charge with offset in arms procurement. In South Korea, the Defence Acquisition Program Administration (DAPA), a civilian-led organisation under the Ministry of Defence, issues defence offsets guideline and carries out offset implementation. In the Netherlands, offset policy becomes an integral part of the industrial policy of the Ministry of Economic Affairs.

Regarding the necessary competency to manage offset, Yang and Wang argue that this should include programme managers, government officers, negotiators, financial experts, legal specialists, engineering personnel, users, and industry representatives.[111] While these people could come from different places and represent different interests, which are not necessarily compatible, the key person is the programme manager who is responsible for the success or failure of the offset programme because of the need to coordinate and integrate the opinions of different organisations and players in this competition game.

3.5 Evaluating Offset's Impact on Defence Industrialisation

3.5.1 Evaluating Offset: the Meeting Strategic Objectives

Numerous efforts have been undertaken to verify the success of offsets, and the majority have taken the form of case studies of a single country by one analyst or a group of authors who are consistent in undertaking longitudinal studies.[112] Such studies provide feedback for their respective governments, and as a result the offset policies and preferences of those countries have changed overtime. Some countries have now moved from using unfocused offsets activity to pursuing the kind of offsets that they believe to bring the most value-added in a sustainable way.[113]

Evaluating the success of offset programmes is a challenging task because the definition of offset success can be challenging. How does one define success? First, offset success can be defined as the fulfilment of offset commitments based on the contract. Second, which is much harder to accomplish, the definition of offset success is linked with the fulfilment of offset objectives. Unfortunately, there is no single universally accepted method to evaluate offsets due to differences in offset objectives and the lack of quantitative data. A number of analysts have proposed to look at offsets' economic contribution through several variables such as job creation and the promotion of skills, the fresh flow of investment capital, the transfer of technology, and forward and backward linkages, as encapsulated in Table 3.3 below.[114]

This study lists seven methods of offset evaluation, which are conducted at different stages of the offset life cycle across four countries: Finland, the United Kingdom, Malaysia, and Indonesia. Both the offset receiver and provider conduct offset evaluation in Finland, which interestingly provides different results. A pre-evaluation of UK's offset approach by Hartley was conducted during the planning stage of offset and aimed to value the best offset proposal, while Matthews conducted post implementation evaluation of a different case but still in the area of aerospace. Balakrishnan conducted offset evaluation in a most comprehensive way, using eight variables for assessment. Yuniorrita and Febrianti respectively conducted post-implementation offset evaluation in two different Indonesian companies.

An interesting case of offset evaluation is the Finnish offset, in which offset impact was measured from both the perspective of a foreign vendor and the offset receiver.[115] In 1999 the National Audit Organization of Finland carried out an audit of an offset agreement three years before the completion of the programme for three purposes: (1) to examine the fulfilment of the offset agreement and its impact; (2) to investigate the achievement of offset goals; and (3) to investigate the cost-benefit of the offsets. The fulfilment of offset is measured by whether the transaction would have occurred in the absence of offset. The audit acknowledges a number of issues, which include the over-pricing of the multiplier coefficient and advance crediting before the offset project concludes. The achievement of the offset goals are measured by the number of new job opportunities, the export share of SMEs and the durability of the business contract. The last purpose, the investigation of offset's cost and benefit, proved to be the most difficult and the audit was unable to reach a judgement on this issue. In 2001, the Bureau of Export Administration of the US Department of Commerce conducted a statistical survey of income and employment data on the largest offset-receiving company in Finland, which forms 30 percent of total offset value. Surprisingly, the two studies produced different results. The first study found that no significant impact occurred as a result of offset, while the latter study concluded that offset was a factor in the increase of income and employment, though not the only one.

Matthews (2014) assessed the impact of the UK requirement of Future Carrier Borne Aircraft on the UK Aerospace industry, which are also the case studies of the UK's biggest offshore commitment holder. He employed six variables: employment, technology transfer, R&D, export, share of company's output, and market access. Among his findings are the following: (1) offset had been useful to maintain jobs and defence industrial capacity; (2) offset subcontracts provide the basis for sustainable development and production work as well as accommodating mutually beneficial partnerships.

In 2000, Hartley and Martin conducted a pre-evaluation of the impact of offset associated with the requirement for Future Carrier Borne Aircraft to the UK aerospace industry and economy. [116] Three variables were employed, being employment, technology, and competitive impact in the form of exports, to create rankings based on quantitative and qualitative assessment. The study employs a number of data collection methods, such as a postal survey of UK equipment suppliers, open source data, and interviews with both offset providers and receivers to obtain data for estimating employment. Technology refers to the value of technology transfer and its possible involvement in life cycle support for the UK and abroad. The study found that by using economic and industrial criteria for ranking, Lockheed Martin's Joint Strike Fighter came top from six contenders for the procurement bid for 3000 jobs of high quality, potentially good on technology, and potential export.

Balakrishnan (2007) conducted a post evaluation of the impact of offset on industrial transformation in Malaysia, using mixed qualitative and quantitative methods. She employed eight variables for evaluation: technology innovation and competitiveness, dual use technology, diversification, market penetration, defence export, job creation, skills enhancement, subcontracting and the promotion of industrial clusters. She found that offset has been successful mainly in three areas: technology capability development, skill enhancement, and diversification. However, offset has been less successful in the area of R&D leading to indigenisation, dual-use technology, the subcontracting base, market penetration, defence exports, job creation, and sustainability.

Yuniorrita (2009) conducted a post evaluation on the role of offset in the enhancement of Indonesian defence industrial capability, using a case study of PT Dirgantara Indonesia (PT DI) under the leadership of Habibie (1976-1998). She employed participatory observation, a literature review, and interviews as her data collection methods. Her findings reveal that offset has worked in PT DI, especially in the form of low added value projects involving manufacture capability and skill enhancement through scholarships provided through offset. She noted that the downside of offset is dependency on foreign components in the supply chain and problems with technology absorption due to low R&D.

Febrianti (2013) conducted a post evaluation on the impact of offset using a case study of PT Pindad (ammunition and landsystems) in Indonesia through 1980-2011. She employed triangulation methods of interview, questionnaire, and secondary data to measure the impact using three variables: employment, technology transfer, and arms import-exports. Her findings reveal that in two cases of offset – license production of the FNC assault rifle and assembly of the Scorpion tank, no significant employment was created, and skill enhancement occurred as there was practically no skills before the offset programme commenced. Also, offset helped to create new skills that reduced imports of components used in these two programmes.

Table 3.3 Compilation of Selected Approaches to Offset Evaluation

Evaluation	Objective	Variable of Assessment	Indicator
National Audit Organisation of Finland (1999)	Measure impact of offset to Finland	1. Income 2. Employment	▪ Value of offset project as percentage of company's total income
BEA of US Department of Commerce (2001)	Measure (short term) impact of offset to Finland	1. Employment 2. Income to firms 3. Transfer of Technology	
Matthews (2014)	The impact of UK requirement of a Future Carrier Borne Aircraft on the UK aerospace industry	1. Employment 2. Technology Transfer 3. R&D 4. Export 5. Share of company's output 6. Market access	
Hartley and Martin (2000)	Impact of offset associated with UK defence exports	1. Employment 2. Technology 3. Competitive impact	▪ Number of jobs and quality of jobs ▪ Benefit from technology transfer and possible involvement in life cycle support for UK and abroad ▪ Export

Evaluation	Objective	Variable of Assessment	Indicator
Balakrishnan (2007)	Evaluate industrial transformation through offset	1. Technology innovation and competitiveness	▪ Types of technology transferred ▪ Benchmarking local defence technology capabilities ▪ Basis of company's competitiveness
		2. Dual use technology	▪ Dual use applicability
		3. Diversification	▪ Utilisation of technology obtained through offset to diversify into other project
		4. Market penetration	▪ Benefit of offset with respect to capability for market penetration
		5. Defence export	▪ Growth in export sales
		6. Job creation	▪ Number of additional job and the types ▪ Sustainability of the job
		7. Skills enhancement	▪ Improvement in worker skills
		8. Subcontracting and promotion of industrial cluster	▪ Contractorisation ▪ Backward linkages
Yuniorrita (2009)	The impact of offset on Indonesian Aerospace	1. Transfer of Technology 2. Skills enhancement 3. Supply chain	
Febrianti (2013)	The impact of offset on PT Pindad Indonesia	1. Employment 2. Technology development 3. Arms import and export (supply chain)	▪ New employment, skills, working hour ▪ Technology absorption, technology innovation, technology know how ▪ Demand of arms and number of arms import

Source: Matthews, R. (2014).' The UK Offset Model: From Participation to Engagement'. *Whitehall Report 1-14*. Royal United Services Institute for Defence and Security Studies; Hartley, K. (2004). 'Offset and the Joint Strike Fighter in the UK and the Netherlands', in: Brauer, J. and Dunne, J. P. (eds.).*Arms Trade and Economic Development: Theory, Policy, and Cases in Arms Trade Offsets*. Routledge, pp. 118-136; Skons, E. (2004) 'Evaluating defense offsets: the experience in Finland and Sweden', in: Brauer, J. and Dunne, J. P. (eds.) *Ibid*, pp. 149-162; Balakrishnan, K. (2007).*Evaluating the Effectiveness of Offsets as a Mechanism for Promoting Malaysian Defence Industrial and Technology Development*. PhD Thesis. Cranfield University; Yuniorrita, S. (2009).*Offset in Indonesian Aerospace*. Masters Thesis. Institut Teknologi Bandung,; Febrianti, A.I. (2013).*Dampak Offset Pertahanan Terhadap Industri Pertahanan Indonesia: Studi Kasus PT Pindad*. Master Thesis, Universitas Pertahanan Indonesia.

Employment

All but one evaluation listed above used employment as one of the variables to measure the impact of offset. Indicators used for this are the numbers of jobs created by offset (Hartley and Martin, Balakrishnan, Febrianti, Matthews), quality of jobs created by offset (Hartley and Martin, Balakrishnan, Matthews) numbers of jobs maintained by offset (Matthews), and numbers of jobs lost by offset on the side of the offset provider (BEA). Using employment as an offset objective and an indicator for offset success has its downsides. Most research suggests that there have been discrepancies between aspirations and reality, and its positive impact (or lack thereof) to the economy. Furthermore, jobs brought in through offset are often centralised in certain regions thus can prolong regional economic inequality. For example, Saudi Arabia initially envisaged about 75,000 jobs would be created through the country's three major offset rogrammes worth US$3.8bn, but Jane's research identified only 3,540 jobs created with the set up of four joint venture companies by 2009.[117] Similarly, South Africa aimed for 65,000 jobs created from the Strategic Defence Procurement Package in 1999, but so far only 13,690 have been created.[118]

Skills Enhancement

Skills enhancement has also been used as one of the offset success indicators (Balakrishnan, Yuniorrita), which often are seen as part of technology transfer. It is indicated by improvement in worker skills (Balakrishnan), as a result of education and training received by the workers (Yuniorrita).

Technology Transfer

Technology transfer has been used as indicator in all evaluations of offset, but researchers approach this differently. Technology transfer can be indicated by the quality of technology (Martin and Hartley, Balakrishnan, Yuniorrita, Febrianti, Matthews), local supply chain creation (Balakrishnan, Febrianti, Matthews), the type of technology ranging from methods, jigs and tools, know how, know why, and so on (Balakrishnan, Febrianti, Yuniorrita). The downside of using technology transfer, as an indicator in offset evaluation is that the technology transferred is usually not new. Depending on whether the offset provider sees the offset receiver as a potential competitor, the OEMs could withhold high value technology to maintain their competitiveness. For example, offsets in the Indian defence aerospace sector did little more than 'reinvent the wheel' as it is locked in an endless succession of license production of Russian fighter jets.

Value Chain Creation

Local supply chain or value chain creation is used as one indicator of offset success (Balakrishnan, Yuniorrita, Febriani, Matthews), but often is incorporated into a technology transfer measurement (Hartley and Martin). In reality, the local supply chain is actually an output from technology absorptive capability upon receiving technology transfer. It is indicated by contractorisation and backward linkages (Balakrishnan), the number of components imported (Febrianti), numbers of components produced domestically (Febrianti, Yuniorrita). The supply chain is also signified by the export of components to the OEMs through buy back or post offset extended contracts, as a signal of product quality.

The downside of using the supply chain as an offset success indicator is that in most cases the offset receiver will be dependent on the OEMs, particularly in value added components or systems. Even though the offset supplier becomes adept in producing a number of components, dependency on OEMs will remain to a certain degree.

Export

Export is one indicator of offset success, when the objective is to improve competitiveness of the company (Hartley and Martin). Export can be made in the form of a complete system, or components/parts. It is indicated by the growth in export sales and participation in the global supply chain. The downside of using export as an indicator of offset success is that exporting arms is not always about competitiveness of the seller. The buyer country could define 'value for money' in accordance with its own rule. Politics, mode of payment - such as availability of export credits – as a deal sweeter like offset, could be a determining factor in procurement bid decisions. There is also the issue of license and arms control agreements. Even though the offset receiver could adapt with the new production capability, its export potential remains uncertain. OEMs could prevent export by forbidding exports to a third country, whenever they see the offset receiver as a potential competitor.[119]

R&D

R&D is one of the advanced indicators of offset success. It is measured by the participation of offset providers in R&D activities in the buyer country (Matthews) and the R&D programme created as consequence of technology transfer from offset (Balakrishna). Study finding by Balakrishna concludes that R&D leading to indigenisation is one of less successful outcomes from offsets in Malaysia. This is due to lack of government support and restricted domestic industry commitment and investment to R&D, absence of specific requests for R&D project from offsets, and limited coordination between R&D stakeholders. Whereas study finding by Matthews suggests that, the UK has successfully harvested various R&D activities and commitment of financial support from foreign suppliers as part of offset programme.

3.5.2 Offset Success Discriminators

Discussion of offset seldom touches the issue of success discriminators, perhaps because it is difficult to pinpoint the primary factors for offset success across countries with different settings. Case studies, the most general form of offset literature, offer lessons learned from a specific country setting, and hardly address the existence of success discriminators. If there is analysis, it has been more on the failure discriminator of offset programme than on success. For example, when offsets in Saudi Arabia through the Al Yamamah Programme fell short in its contribution to job creation and skill enhancement, it was the bureaucratic and administrative systems of a country instead of technology and economic systems that took the blame for not able to optimise advantage from the transfer of technology.[120] Other variables often linked to offset failure in small countries are the lack of economies of scale, weak procurement budgets, low local production and technology capability.

One of the most valuable debates on offset success discriminators is via a master's thesis by Deborah Kremer and Bill Sain.[121] They consider two phases in the development of offset when addressing the issue of success: the first phase, development and implementation, and the second phase, execution. They identify 22 factors that comprise six buyer-related factors, eight seller-related factors, five contract-related factors, and three product-related factors (Table 3.4). This is one of the most comprehensive accounts to address the issue of offset success discriminators; however, the authors' research includes a literature review of countertrade, international joint ventures, international cooperative projects, and international contracts, in addition to offset programmes.

Table 3.4 Factors Affecting the Success of Offset Agreements

Buyer-related: • International Experience • Offset experience • Not viewed as competitor • Technical experience • Sufficient financial resources • Stable environment	**Seller-related:** • Compatible Goals • Proactive Strategy • In-house Offset Group • International Experience • Offset Experience • Large Company • Commitment to Project • Top Management Support
Contract-related: • Transferability of Obligations • Dual Contracts • Large Dollar Value • Long Payback Period • Low Penalties	**Product-related:** • Mature Technology • Complex Product • High Visibility of Product

Source: Kremer, D. and Sain, B. (1992). *Offset in Weapon System Sales: A Case Study of the Korean Fighter Program*. Master Thesis. Faculty of the School of Systems and Logistics of the Air Force Institute of Technology Air University.

Molas-Gallart notes that focused objectives and negotiation skills play an important role in the case of Spain. Its purchase of 84 F-18s ended up in a higher value of indirect offset despite the initial plan being only for direct offset. It turned out that indirect offset provides a better commercial value compared to direct offset, which gives more emphasis on technology capability. Spain did not succumb to indirect offset, however, but in the end renegotiated a more focused direct offset that gave it capability in maintenance and support of the purchased system.[122]

Matthewsemphasises the significance of mature defence economies in the success of offset, which is signified by procurement scale, engineering skills, industrial capacity, and technological infrastructure. He argues that technology absorptive capacity is the critical success factor in offset programmes, which he defines as the:

> "Possession of an educated and highly trained workforce; existence of a diversified and innovative subcontractor base, structured across clusters of horizontally and vertically integrated high technology companies; and the ability to dynamically involve local technologies where intellectual property rights can be conferred."123

Furthermore, he argues that if procurement scale, engineering skills, industrial capacity, as well as technological infrastructure are already in place, the obligor can be expected to exploit the commercial incentives arising from such mature defence economies.

3.6 The Lingering Offset Challenge

3.6.1 Notion of a Cost Premium

Offset premium cost is an additional expense that occurs due to the implementation of offset. This has been a problem because of the expectation that offsets will reduce arms procurement costs to the importing country.[124] Countries seem wedded to the idea that offsets are free goods and are reluctant to publicly admit that offset costs more than off the shelf purchase.[125] Taylor, for example, warned that the extra variable and fixed costs are usually passed on to the buyer - at least partially- in the form of a higher price of the base good, through a practice known as price padding.[126]

Offset cost has become a sore point in offset transactions, both for the provider and receiver. In general, the offset receiving country refuses to accept the burden of offset premium cost. Malaysian offset policy, for example, refuses to credit the cost premium as an offset. However, the government of Malaysia does acknowledge that some costs are incurred because of offset, such as official travel claims and passports.[127] Similarly, the South Korean government allows some costs to be credited as offset. Meanwhile from the perspective of the offset provider, the US Government not only recognises this cost but also allows US contractors to recover the full cost of offset implementation. This mechanism is only allowed in Foreign Military Sales (FMS) purchases under condition that the Letter of Agreement (LOA) is financed wholly with customer cash or repayable foreign military finance credit.[128]

In practice, many countries recognise and pay for the additional cost. When European nations bought the F-16 from America's General Dynamics company in 1975, they paid an extra 34 percent which excluded the costs of the extra time and delays involved in the co-production programme.[129] Table 3.5 shows a compilation of offset premiums across five countries: the Netherlands, the UK, Malaysia, Finland, and Belgium. Offset cost premiums vary greatly from 2.9 percent to 30 percent of procurement contract value. Among the five, The Netherlands and Belgium respectively recorded the lowest and the highest offset premium cost of 2.9 percent and 20-30 percent. These numbers need to be deliberated with precaution, as it is likely that countries do not calculate offset premium in the same way.

Table 3.5 Offset Premium Costs in Selected Countries

Country	Offset premium cost as percentage of procurement contract value
The Netherlands	2.9 (in average)
UK	3-5
Malaysia	4-15
Finland	10-15
Belgium	20-30

Source: Hartley, K. (2005). 'Offsets and the Joint Strike Fighter in the UK and the Netherlands', in: Brauer, J. and Dunne, J. P. (eds.) *Op.Cit.* ; Skons, E. (2004). 'Evaluating defense offsets: the experience in Finland and Sweden' in: Brauer, J. and Dunne, J. P. (ed.). *Loc.Cit.*; Struys, Wally (2004). 'Offsets in Belgium: between Scylla and Charybdis?', in: Brauer, J. and Dunne, J. P. (ed.). *Loc.Cit.*; Balakrishnan, K. (2007).*Evaluating the Effectiveness of Offsets as a Mechanism for Promoting Malaysian Defence Industrial and Technology Development.* PhD Thesis, Cranfield University.

This fact begs three questions: *first*, how exactly does a country calculate offset cost premiums and who should bear them; *second*, why are offset cost premiums low for one country and higher in others; and *third*, does offset cost premiums render offset as a worse choice in terms of cost effectiveness when compared to other choices such as off the shelf or collaboration?

It is not easy to verify the existence of an offset premium cost and to pin down its exact value. Table 3.6 shows an example of an 'offset administrative cost' that the US government allows its defence companies to reimburse. The cost will subsequently be added into to the price of procurement for the buyer country. A number of methods have been suggested for this purpose. For example, Taylor suggests a complex approach which involves the purchasing government computing the economic cost of the offset arrangement that includes the opportunity cost of resources that are redirected toward the offset as well as the additional variable and fixed cost to fulfil the offset. However, this method requires that non-offset procurement strategies be calculated in terms of finance and that variable costs as well as fixed costs be identified before deciding to use offset.

Table 3.6 Example of offset administrative costs

1	In-house and/or purchased: organization, 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
2	Off-shore operations for technical representative and consultant activities, office operations, customer and industry interface, capability surveys;
3	Marketing assistance and related technical assistance, transfer or technical information and related training
4	Employee travel and subsistence costs
5	Taxes and duties

Source: Defence Federal Acquisition Regulation Supplement Section 225.7303-2(a)(2)(iii)(C). In: O'Connor, L.L. (1992) 'Contractor Recovery of Offset Administrative Costs'. *The DISAM Journal*, Summer.

What makes offset premium cost arise? Balakrishnan (2007) believes that it is affected by: *first*, the tendency of foreign vendors to load transactional costs, including risk contingencies, into both the primary defence contract price and offset package value; *second*, amended or additional offsets demanded late in negotiation will force foreign vendors to raise the cost premium to mitigate the risk of non-fulfilment of obligations most prominently in direct offset. On the other hand, greater transparency of offsets requirements such as process, implementation, and monitoring, is believed to have a positive impact in reducing the offset cost premium, but interestingly, procurement strategy does not seem to have an impact on offset cost. While it is assumed that the rise of offset premiums might be more evidentin sole-sourcing procurement since there is neither competition nor comparison, this is not necessarily true due to information asymmetry in the arms market.

3.6.2 Spectre of Corruption

In 2010, Transparency International issued a report on the risk of corruption in offset due to the lack of transparency, monitoring, and evaluation, incentivisation, and project completion (Transparency International, 2010).[130] Here, corruption can take the form of improper influence on acquisition with the rewards coming through offset, improper influence on the award of the contract, theft of funds allocated to the offset, using offset as vehicle for payment of bribes, and mutual agreement between the offset provider and receiver on non-performance of the obligation. The report uses the case of corruption allegations linked to offset deals in arms procurement in South Africa, Portugal, and Greece. It concludes that the potential of offset-related corruption seems to be higher in an environment of overly prescriptive offset policy operated under closed regimes and, in contrast, marginalised in a more open and competitive environment. At the end, the report suggests that offset should be banned.

Matthews (2014) criticises the report as flawed, due to the "superficial methodology employed and flimsy evidence offered"[131]. He argues that corruption allegations have more to do with the general procurement system, rather than the offset itself. However, he does not dismiss the possibility of corruption related to offset in developing countries with low levels of industrial capacity. If such a country demands direct offset, the offset obligor could be tempted to bribe to achieve agreement on fulfilment with the receiver, that otherwise be difficult to accomplish.

A more elaborate study on offset related corruption can be found in Platzgummer's study (2013) on the type of corruption related to offset in a time series analysis covering the period of 1980-2012.[132] He concludes that only relatively small numbers of countries had engaged in seven different types of corruption. He emphasised that while the tendering process is prone to manipulation, no evidence had been found so far for actual corruption.

Another study by Lambrecht (2012) argues that offset is vulnerable to corruption due to a number of factors.[133] First, offset distributes large sums of money as incentives in highly competitive negotiated government procurements. Since much offset work seems disconnected from the purchased items, this raises a suspicion of improper or corrupt inducement. Second, government often has murky or confused policy goals when demanding offset. Measuring the security gains from procurement is already difficult because of the cost-effectiveness v dependency dilemma, let alone adding the political and economic reasons that are often represented by offset. Third, offset combines a high value economic asset with a lack of transparency, due to national security concerns and complex transactions and accounting practices. Difficulty in monitoring offset makes it easier for corruption to occur. Fourth, the involvement of a third party, i.e. foreign consultant, offset broker, to develop and manage offset transactions adds to the risk of corruption in offset. Lambrecht believes that these problems can be managed using existing anti corruption tools.

3.6.3 Sustainability

Offset programmes have been criticised for their short-term character, hence the benefit often does not last long enough to sustain the accomplishment of the purchasing country's strategic objective. Because the interest of the offset provider is merely to fulfil offset requirements, it will shift resources to other countries where it has outstanding offset commitments. This is understandable considering the growth in the numbers of countries that use offset in an obligatory way. As a consequence, many manufacturing facilities and skills created through offset are neglected once the offset programme concludes. Matthewspoints out that this problem signals a lack of strategic vision and planning by both the offshore vendor and the recipient country's offset authority.[134]

As a response to the short-term character of offset, the time horizon of those seeking offset seems to have lengthened. There is a move away from broadly defined short-term offset work towards a more focused long-term investment strategy. For this purpose, many countries allow a firm to bank offset credits in anticipation of a future obligation and this provides an incentive for the foreign defence contractor to continue placing work with domestic manufacturers. Offset credit banking is a unique mechanism that allows offset providers to accumulate credits, which can later be used to meet future offset agreements. This provides an opportunity for buyers to achieve sustainable benefits from offset agreements. From the perspective of the provider, banking credits serve as a kind of incentive to place work with domestic industry beyond the offset contract time horizon. Offset credits that can be banked are varied: it can be value-adding activities carried out by a prospective provider in pre offset discharge period or 'pre-offset' credit, or surplus in offset discharge. The downside of offset banking is its complexity, thus making it unsuitable for a country with only minor experience in offset.

In addition to overcoming short-termism of offset through credit banking, Martin suggests that a number of countries now seek to draw foreign firms into the domestic economy through either equity investments in existing domestic firms with an incentive to continue to place work in the domestic economy, as well as to share other skills as this increases the profitability of their overseas investment. This can be interpreted as an emphasis on the success of offset strategy in laying the foundations on which future joint ventures could be built.[135]

3.7 Summary

This chapter has undertaken a broad sweep of the literature covering both the conceptual and empirical aspect of defence offset. As a concept, offset is full of controversy, but as a government policy toolit has gone far to pursue a number of strategic objectives related to defence, development, and dual-purpose. While offset policy and practices vary widely, from mandatory to case-by-case basis, there are elements of offset –such as threshold, multiplier, penalty, and so on- that should be clarified as reference for offset planning, negotiation, and evaluation. Offset implementation in arms procurement undoubtedly adds to the complexity, thus should be well prepared and run by a competent body or human resources. The effectiveness ofoffset differsacross countries, but there are at least six areas where offset could be beneficial: employment, skill enhancement, technology transfer, value chain creation, export, and R&D.

Reference and Notes

1 In its Agreement on Government Procurement (GPA), WTO prohibits the use of offsets, which was defined as “measures to encourage local development or improve the balance-of-payments accounts by means of domestic content, licensing of technology, investment requirements, counter-trade or similar requirements”. However, it is also stated that government has the right to negotiate offsets, on the basis that it is only used for the qualification to participate in the procurement process and not as criteria for awarding contracts. Available at: http://www.wto.org/english/tratop_e/gproc_e/gpa_overview_e.htm(Accessed 30 December 2010)

2 US Department of Commerce Bureau of Industry and Security (2007). ’Offsets in Defence Trade’.*Eleventh Report to Congress*, January 2007.

3 EDA issued Code of Conduct on Offsets on 2008, limiting offsets to 100% of contract value, and set framework to increase transparency in policy and practices of each member country. Available at: http://www.eda.europa.eu/genericitem.aspx?area=2&id=420(Acessed 22December 2010). In 2010, the organization issued a report on the application of abatement in offsets. Available at: http://www.eda.europa.eu/newsitem.aspx?id=637(Accessed 2 Feb 2011)

4 Dunne, P. (2000). ‘Arms Offset Dubbed A “Necessary Evil”’, *Aviation Week & Space Technology*, 11 December.

5 Fryer-Biggs, Z. (2012). ‘Are Offsets Becoming Unaffordable?’, *Defense News*, 27 October. Available at: http://www.defensenews.com/article/20121027/DEFREG02/310270002/Are-Offsets-Becoming-Unaffordable- (Accessed 11 December 2014). See also Chuter, A. (2013) ‘As Firms Target Exports, Offsets Create Headaches’ *Defense News*, 20 May. Available at: http://www.defensenews.com/apps/pbcs.dll/article?AID=2013305200024 (Accessed 11 December 2014)

6 Martin pointed out two causes: first, although countries are initially employed best endeavour approach in offset contracting, they learned that financial penalties for the non-fulfilment of offsets proved a better incentives rather than much more vague best endeavour; second, the recognition that offset cost more than just off-the-shelf purchase hence there is need to concentrate scarce resources in specific areas. See Martin, S. (1996) *Op.Cit.*

7 ‘Offset to Grow by USD50 Billion a Year as Firms Face Problems Clearing Obligations’, *Jane’s Defence Industry*, 30(3), 1 March 2013.

8 ‘Saudi Arabia becomes world’s top arms importer’, *Russia Today*, 9 March 2015. Available at: http://rt.com/news/238881-saudi-arabia-arms-import/ (Accessed 2 April 2015)

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by the parliament. One way to escape from this dilemma is to raise the range of multiplier, so that the offset obligation value as percentage of arms procurement contract can be met.

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108 Brauer, J. (2004).*Op.Cit.* p. 87

109 Brauer, J. (2004).*Loc. Cit.*

110 Platzgummer, P. (2013) 'Arms Trade Offsets and Cases of Corruption: The Usage of Anti-Corruption Tools in Special Forms of Arms Acquisitions', *International Public Management Review*, 14(2), pp. 17-38.

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113 For example, Australia no longer sees transfer of technology as feasible offsets program due to its minimum chance of success in the past; it is now aiming to channel economic benefits from defence procurement for industrial participation in the global partnership. Furthermore, as affordability becomes the main concern of small countries, they are now becoming more selective in retaining part of industrial base deemed to be most critical. Countries like the United Kingdom and Australia have worked on a list of critical technology and use industrial participation to retain and hone this capability.

114 Llyod, D. (2005) 'Weapon Procurement and Development: Do Offsets Mitigate or Magnify the Defence Burden?', in: Brauer, J and Dunne, P.(eds) *Op. Cit.* pp. 21-33.

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124 Brauer, J. and Dunne J. P. (2009) 'Arms Trade Offsets: What Do We Know?' Paper prepared for the forthcoming Coyne, C. (ed.). *Handbook on the Political Economy of War*. Edward Elgar. Available at: http://carecon.org.uk/DPs/0910.pdf (Accessed 29 December 2013)

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128 For discussion on how the US Government manage the issue of offset implementation costs see O'Connor, L.L. (1992) 'Contractor Recovery of Offset Administrative Costs', *The DISAM Journal*, 14(4), pp. 108-110; Milligan, J.E. (2003) *The determinants of united states government policy and practice toward offsets in international trade*. Master's Thesis. Naval Post Graduate School, Monterey, California; Kane, R. (2003) 'National Governments and their Defence Industrial Bases: A

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130 Transparency International (2010) *Addressing the Risks of Corruption and Raising Transparency*. http://old.acrc.org.ua/file_collection/TI_Defence_Offset_Report_20101.pdf(Accessed 2010)

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133 Lambrecht, R.J. (2012) *The Big Payback: How Corruption Taints Offset Agreements in International Defense Trade*. Masters Thesis, University of Texas.

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4. INDONESIAN ECONOMIC TAKE OFF THROUGH THE FOSTERING OF STRATEGIC INDUSTRIAL CHAMPIONS

4.1 Introduction: Planning for Development Push

This chapter aims to provide the context for offset policy making and implementation in Indonesia. For that purpose, factors that influence the course of Indonesian technology development and accelerated industrialisation, in which offset will serve as a technology transfer conduit, will be explained. Technological development and technology policy are vital to Indonesian development for a number of economic and political economy considerations.[1] First, imperfections in certain segments of the international technology market should allow Indonesia to acquire some basic technological competence to assess, assimilate, and diffuse technology. Second, because Indonesia entered the phase of export-oriented industrialisation in the 1980s as a latecomer compared to its neighbours, it needs a *niche* to be competitive. Third, technological planning has to be done in advance due to the long lead times in the establishment of technological capacity.

This chapter will be structured as follows: section 4.2 highlights the post-war industrial beginnings when early attempts at government intervention were taken to initiate rapid industrialisation and lessen dependency on natural resources. This period also witnessed the swings of the policy-making pendulum that had been influenced by economic nationalists and technocrats. As has been observed in a number of writings[2], this pendulum reflects the competition of influence between advocates of comparative advantage and those of competitive advantage when it comes to determining industrialisation strategy.Section 4.3 explains technology planning and strategic industrialisation as the brainchild of Habibie - the Minister of Research and Technology - to realise the then President Soeharto's vision for economic take off. Facing the impediments of financial and human resources, ten industries were selected and labelled as strategic. They were to be the vehicle of industrial transformation, through which technology progress was expected to accelerate in a relatively short period of time. Section 4.4 addresses the issue of dual use industrialisation and technology as a spearhead to ensure military expenditure contributes to broader economic development through demand created from the military modernisation plan; it would support wider industry to gain technology transfer, broadening production scale.

4.2 Indonesia's Post-War Industrial Origins, and the Path to Economic Nationalism

Since independence in 1945, development strategy in Indonesia has been subjected to competition, and such pressures continued throughout the New Order period (1968-1998). Economic independence was a critical issue after the country survived the War of Independence (1945-1949). It inherited a staggering debt of USD 1.13 billion from the pre-war Dutch administration,[3] damaged agriculture, weakened industrial and physical infrastructure and estates, and food crop production was a mere 70-75 percent of pre-war output.[4] Most of the country's economic assets were owned and controlled by Dutch and foreign nations that also dominated trade, restricting the manoeuvrability of Indonesia's policy makers.[5] As consequence, the first debate on development strategy was between those who wished to nationalise all foreign assets versus the technocrats who advocated macroeconomic stability. The second faction saw the benefit of allowing a Dutch business presence, while at the same time cultivating strong domestic economic actors. Although the advocates of macro economy won, divisions over development strategy continued and nationalisation gradually took hold.

The first industrialisation attempt was carried out under President Soekarno through *Program Benteng*[6], Economic Urgency Plan/ Industrial Urgency Plan 1951 and First Five Year Development Plan 1956-1960[7]. Government planning was formalised with the creation of the Agency for National Development Planning (BAPPENAS) in the 1960s, which was in charge of macroeconomic planning. At the time, the economy was heavily engaged in agriculture (56 percent of net domestic product), with a small manufacturing sector that mainly served to process export crops worth around 8-10 percent of net domestic product[8]. Due to Soekarno's anti neo-colonialism politics, foreign investment was only open to the Soviet Union, China, and East European countries. The era witnessed the establishment of an industrial base for manufacturing, including fertiliser, cement, automobiles, shipbuilding, and general engineering.

The initial industrialisation effort was far from successful, because of political instability within the parliamentary system. Furthermore, Indonesia had to deal with a number of security threats from armed insurgencies, from the Trikora campaign against the Dutch stronghold in Western New Guinea (1961-1962), and *konfrontasi* against the Federation of Malaya (1963-1966). As a consequence, the local manufacturing industry recorded tortuous growth of 1 percent throughout 1960-1967[9]. When Soekarno was removed from office following the violent political upheaval in 1966, the country faced economic bankruptcy: a massive debt of USD 2.5 billion and industrial output below 20 percent of capacity[10]. Hill noted that by the mid 1960s Indonesia was a 'chronic economic drop out'. This, however, would prove to be one of several economic and political downturns from which the country survived as a resilient nation.

4.2.1 Open Door Policy and Import Oriented Industrialisation

The second industrialisation began as Soeharto became the country's second President, in an era that was later defined as the New Order (1966-2008). By the time Indonesia kick-started industrialisation, it was already a latecomer compared to neighbouring countries in Southeast Asia that had embarked upon industrialisation one or two decades earlier. Hence, catching up became the preoccupation of the President.

Soeharto began his economic policy by choosing a team of economists with a technocratic approach and a Western orientation to rehabilitate the economy[11]; these technocrats subsequently held strategic positions in BAPPENAS. The First Five Year Development Plan, Repelita I (1969/70-1973/74) was prepared with the assistance of the World Bank and IMF, aiming to consolidate the economy. The open door policy to foreign and domestic direct investment was introduced in 1967 and 1968, respectively, through the State Agency for Investment Coordination (BKPM). Throughout the latter 1960s to the beginning of the 1980s, Indonesia pursued an Import Substitution Industrialisation (ISI) strategy as a result of unfulfilled domestic demand, rapid economic growth led by increased commodity prices, and strong government intervention.[12]

The open door policy resulted in a balanced budget and restrained hyperinflation from 1,136 percent in 1966 to 17 percent by the 1970s[13] as well as inflows of raw materials and intermediate goods for the manufacturing industry. However, dependency on foreign capital continued to increase; for instance, in 1972/1973 foreign aid was equal to 21.1 percent of all government revenue.[14] Entering the 1970s, high dependency on foreign capital, especially Japanese investment, led to a negative sentiment eventually culminating in the 'Fifteen of January Tragedy '.[15]

4.2.2 The Return of Economic Nationalism, Leading to 'Take-off' Ambitions

The first oil bonanza of 1972-73 lessened the significance of foreign aid in Indonesia.[16] The following year saw a policy swing towards protectionism, such as more restrictions on FDI and support for native business players to thrive. The push for efficiency and the shift to export-oriented industrialisation was ignored and, instead, Soeharto no longer saw the technocrat approach as adequate. As a consequence, the influence of the technocrats gradually faded.

At the same time, Indonesia was facing urgent development, issues such as rapid population growth, inadequate transportation infrastructure within the archipelago, and environmental problems pertaining to over exploitation of natural resources.[17] The economy was heavily unbalanced with an overly strong reliance on oil and natural resources, on the one hand, with oil forming three quarters of all exports in the 1970s, and slow manufacturing growth on the other.[18] Pertamina, the state oil company, singlehandedly contributed to the state's biggest income. The manufacturing industry -such as basic metals and plywood- grew significantly while agricultural industries declined. Nevertheless, agriculture remained the biggest employment provider whereas manufacturing industry provided 14 percent of total employment during the 1970s due to their capital-intensive nature[19]. In order to tackle the abovementioned problems, Repelita II (1974/75-1978/79) prioritised employment provision, the development of raw material processing industry, as well as agriculture and infrastructure.

Meanwhile, Soeharto had a clear vision about the future of Indonesia. As early as 1971, Soeharto had talked about economic take-off[20], sharing this passion with Vice President of Germany's Messerschmitt-Bölkow-Blohm B.J. Habibie on 'transformative industrialisation' or development with a 'value-added orientation', where technology plays the central role. In 1974, Soeharto through the Director of Pertamina, Ibnu Sutowo, requested Habibie to return to Indonesia to accomplish three important tasks: first, to set up an agency for assessment and implementation of technology; second, to create an aerospace industry; and third, to establish a scientific centre.[21] Habibie came home to lead the Advanced Technology and Aerospace Industry (ATTP) division under Pertamina. One year later, a massive debt scandal brought down Pertamina, rendering the ATTP as short-lived. Within this short period, Habibie managed to use ATTP as a preparation ground for the required human resources and the funding for the establishment of BPPT and IPTN.

4.2.3 Constructing the Technological Base for the 'Catch-up'model

During 1980-1982, the Indonesian economy experienced an alarming slowdown due to the world recession. Following a similar pattern years earlier, the technocrat's influence returned whenever crisis struck the country. This time deregulation and Export Oriented Industrialisation (EOI) based on comparative advantage were adopted to compensate for falling oil incomes and the payment of foreign debt. Countertrade policy was also adopted in 1982 as a temporary measure to maintain economic growth through the export promotion of non-petroleum and mineral products; the policy included offset implementation linked to public procurement of high technology.

The concern of government policy at this stage was how to accomplish the 'deepening' and strengthening of industrial structures, expand the machinery and electronics industry, develop small and medium industry, export manufactured products, as well as develop technological capability in industrial planning and engineering. The manufacturing sector recorded dismal growth, contributing only 12.7 percent to national income, much less than agriculture and mining, that contributed 23 and 20.8 percent, respectively.[22] Repelita IV (1984/85-1988/89) set a long-term objective to expand the industrial sector to equal that of agriculture.

The initial attempt to promote technology development was recorded in 1960s, when the Minister of Higher Education and Science was created and then transformed into MENRISTEK in 1976. In the Soeharto era, the institutional framework for a technology base was laid down through the creation of BPPT in 1978. The National Research Council (*Dewan Riset Nasional*, DRN) was created in 1984 to assist MENRISTEKin formulating strategic plans, most importantly the Prioritised R&D sector (PUNASRISTEK). Research was directed towards supporting and accelerating national development, hence the emphasis on applied rather than basic research.

The government had a vital role in technology development because it provided most of the R&D budget, which in 1979 amounted to 0.45 percent of GDP.[23]The role of the private sector was minimal, owing to the lack of a research culture, a preference for trading, the lack of incentives for foreign investors to invest in R&D activity, and limited cooperation between private and public R&D institutions.[24] In the absence of strong local R&D activities, the external sources of technology transfer, such as FDI and imported technology became important. Unfortunately, the highly restrictive regime since 1970s rendered FDI as an insignificant channel of technology transfer. Furthermore, as noted by Wie, FDI projects in Indonesia in general did not have fully-fledged R&D units, only small laboratories for product testing and quality control only.[25]

Industrial deepening and the transformation of the economy from agriculture to industry, as enunciated in Repelita, called for technological progress, but the private sector lacked any significant contribution, and thus was not expected to take the lead in the process. Habibie's answer for this challenge was transformative industrialisation through a progressive manufacturing plan, human resource development, strategic industries, and protection of the domestic market through import substitution. The basic idea was to have developing countries like Indonesia conducting transformation through technology transfer via an accelerated process, taking into consideration socio-cultural challenges. The consequence of such an idea was government intervention at a much higher level than before. Although the technocrats recognised a disconnect between economic and fiscal reality, this transformational plan was passed due to support from the President, who held control over the budget.[26]

4.3 Mapping Out the 'Strategic Industry' Paradigm

4.3.1 Technology Planning and Industrialisation *a la* Habibie

Writings on Indonesia's technology development in general have applauded the centrality of Habibie.[27] He held position as State Minister of Science and Technology as well as head of BPPT for two decades, making him the longest serving minister before being elevated to the Vice Presidency in 1997, and then the Presidency in 1998-2000. It might be argued that his closeness to Soeharto was responsible for the longevity of his career, but none can deny his own exceptional intelligence. He has been known as 'Mr Crack' after his ability to resolve problems of stress cracks in aircraft frames, a process that later was incorporated into the maintenance of NATO missile systems.[28] An inspiring and larger-than-life Indonesian figure, it is not an overstatement to state that Habibie's name is indistinguishable from technology progress in Indonesia.

Although Habibie's training was as an engineer, he was amazingly economic oriented.[29] His creative thinking was clearly articulated and well documented in a two-volume book compilation of his speeches, spanning across two decades, 1980s-1990s. The most comprehensive of Habibie's thoughts on industrial transformation were in the paper he presented at *Deutsche Fur Luft-und Raumfahrt* in Bonn, 14 June 1983, entitled 'Some Thoughts on Industrial Transformation Strategy of Developing Country'.[30] Here, Habibie argues that the industrial transformation process is part of 'nation building', which he defined as independence in economy, society, cultural identity, and political integrity. He believes that technology development, instead of natural resources, is vital to the process.

According Habibie, there are five basic principles in the implementation of science and technology as a basis for nation building. First, education and training in all sectors relevant to development. Second, a clear view of the required technology to address real world issues. Third, the transfer, implementation and development of technology must be done in accordance with contextual reality. Fourth, the determination of the state to solve its problem independently by reducing reliance on technology imports. Fifth, the need to protect national capability in the early stages of transformation until the economy achieves competitiveness. Habibie emphasises that the state has to plan the achievement of international competitiveness in the shortest time possible.

For the abovementioned purpose, Habibie offers the concept of a 'vehicle for technology and industrial transformation' (*wahana tranformasi teknologi dan industri*), based on two conditions: first, the value added processes associated with industrial deepening through a 'progressive manufacturing process' to achieve levels of competitiveness comparable to advanced countries.[31] Second, the need for a huge potential market in both the domestic and international arenas to permit optimal economies of scale, high quality production and an after sales service. Habibie believes that a large domestic market would enable Indonesia to build its own planes and develop related strategic industries.[32]

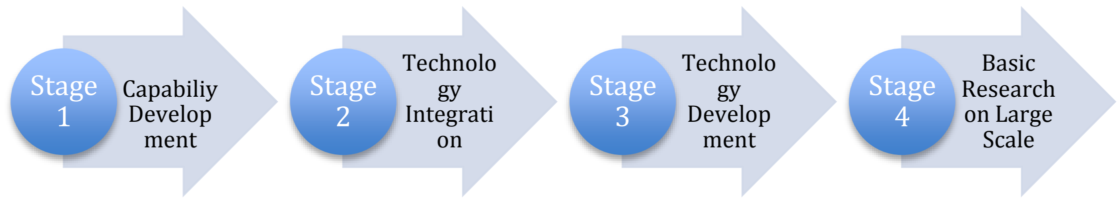
4.3.2 First Condition of the Transformation Vehicle: Progressive Manufacturing Plan (PMP)

The idea of a 'Progressive Manufacturing Plan'[33] (PMP) was based on a version of reverse engineering or the Ladder of Production(see chapter 2p.43). The Plan is divided into four stages, starting from the mastering of existing technology and ending with basic research (see figure 4.1). Habibie believes that industry will be in charge of stages one and two, while the R&D institution should take the lead in stages three and four to support the industry.[34]

The first stage focuses on building capability to master advanced design, technics, and production that were developed abroad. Habibie refuses investment in local R&D at this stage, believing that the effort will end up 'reinventing the wheel'. Instead, he was convinced that technology transfer through license production makes the most sense, but this must be guaranteed through linking the level of technology transfer with the number of units of production (scale).

The second stage focuses on technology integration into the new product. This stage would see the development of capability in design and blue print making, integration, optimisation of component, and above all, the ability to select the best design. Habibie was convinced that many foreign providers would be eager to offer their leading-edge designs and products, hence domestic capability on testing, management, marketing and simulation would need to be developed further. As a consequence, the role of R&D facilities becomes important.

Figure 4.1 Habibie's Progressive Manufacturing Plan



Source: Author

The third stage focuses on technology development, enabling developed countries and NICs to maintain competitiveness. This stage requires innovation to develop components or parts of the best technology in each respective sector. Habibie assumed that companies and countries would face theoretical impediments in their research, which generate the need for basic research. This is when the fourth stage comes in; that is, conducting basic research on a massive scale. Habibie understood that financial resources, facilities, and human resources are scarce in a developing country; hence he put basic research as a last priority compared to the other stages. He argued that most basic R&D was conducted in advanced countries, which could be accessed by developing countries through R&D cooperation agreements. The progressive manufacturing plan relied on both industry and R&D institutions.

4.3.3 Second Condition for the Transformation Vehicle: A Captive Market

Habibie believes that domestic market protection is the second condition for the transformation vehicle. Developing countries with limited domestic markets need to plan a programme that will enable a selected industrial product to compete against rivals in the international market. As for developing countries with a high demand for selected industrial products, they need to have production technology advanced enough to compete in the domestic market. Habibie cautions that developing countries should not seek transfer of the most advanced technology as that is too highly specialised - such as rotary blades and engines - because the domestic demand is low and barriers to enter the international market are high.

An orientation to the domestic market is essential, because in order to be competitive, a product must fulfil a number of requirements: first, the economies of scale are close to optimal; second, the quality of the product and after sales service must be reliable. Habibie was convinced that without temporary protection, it would be impossible to achieve optimal production scale and sufficient quality of product and aftersales. This protection could be removed once the production scale reaches optimal scale and the capability has been properly institutionalised. It was obvious that Habibie's train of thought followed the argument of infant industry protection.

The idea that strategic industries must be sheltered from competition in the domestic market was implemented through a number of regulations on import restriction, a tax levy, and most importantly, public procurement. Import restriction, for example, was applied to aircraft products similar to those that national industry would be capable of producing. Public procurement undertaken by state-owned enterprises and government departments/institutions, including the Armed Forces, must lodge an application for technology import approval. Presidential Instruction No.1 Year 1988 stated that no order could be made without approval of a coordinating committee that includes representatives of BPPT and the Ministry of Finance.[35] For example, Garuda Indonesia Airways had to secure approval from BPPT before importing aircraft from Boeing. Another way to make domestic industry more competitive is to provide a tax levy on imported components of aircraft and other products, as determined by the President during the cabinet meeting in December 1986.[36]

4.3.4 Nine Industrial Transformation Vehicles

Habibie determined that nine vehicles for industrial transformation were required, and he prioritised them accordingly, as: aerospace, maritime and shipbuilding, land transportation, telecommunication, energy, engineering, tools and agricultural machinery, defence industry, and related industry.[37] The first four vehicles, transportation (land, sea, air), and communication and electronics, are closely linked to the political and economic integration of an archipelagic country, which he believed to be the most appropriate industries to channel and develop technology. A target was set for these industries to achieve stage three or even stage four of the progressive manufacturing plan within the course of 20 years.[38]

As the abovementioned industries grow, they will provide more employment needed to boost income. Increases in income will raise energy demand, which justifies the strategic position of the energy sector, including the manufacture of turbines, generators, and energy transmission tools, as the fifth vehicle. The sixth vehicle refers to the engineering industry, required to process energy and mineral resources as well as agriculture outputs such as sugar, palm oil, petrochemicals, cement, paper, and many more products. The seventh vehicle is agricultural tools and machinery needed for 'extensification' and mechanisation of agriculture, to respond to the decreasing available land under population outside Java Island. All of these investments in development would bear fruit and must be protected from internal and external threats, which call for the existence of eighth vehicle, which is the defence industry. This industry relates to both weapon systems and the platforms in which the weapons are embedded, such as aircraft, ships, and land vehicles.

Interestingly, Habibie's notion of the ninth industry did not refer to any specific sector of industry, unlike the others. He was convinced that the development of all eight vehicles would eventually stimulate supplier industries to grow through backward and forward linkages.[39] These industries, previously considered less strategic due to limited demand - such as aircraft rotary blades and hydraulic systems - will sprout due to the increasing demand for their products. All industries that grow due to the spill over effects of the other eight industries will be the embodiment of the 'tangible ninth vehicle'.

The idea of nine vehicles for industrial transformation was to be realised in stages. One by one, state owned enterprises were appointed as strategic industries through Presidential Decrees in 1980, 1983, 1984, 1986, and 1989. Presidential Decree No.44 in the Year 1989 defined a strategic industry as an "industry being granted status as strategic by this decree". This definition was simple but at the same time, final. The fact that the decree was issued by the President, who under an authoritarian system held unchallenged authority, was very effective in putting down any opposition to the choice of industry.[40] In total there were ten State Own Enterprises (SOEs) designated as strategic industries as shown in Table 4.1 identifying the Ten Strategic Industries in Indonesia.

Table 4.1 Ten Strategic Industries in Indonesia.

No	Industry	Founded	Product
1	PERUM DAHANA	1966	Explosives
2	PT Boma Bisma Indra (BBI)	1971	Machine tools, construction equipment
3	PT Barata Indonesia	1971	Machinery and engineering service
4	PT Industri Telekomunikasi (INTI)	1974	Telecommunication
5	PT IPTN	1976	Aircraft, weapon systems
6	PT Krakatau Steel	1978	Integrated iron and steel product
7	PT PAL Indonesia	1980	Shipbuilding, general engineering
8	PT Industri Kereta Api (INKA)	1981	Rolling stock
9	PT PINDAD	1983	Small arms and heavy equipment
10	LEN Production Unit	1965	Electronics and communication

Source: Raillon, F. (1990) *Indonesia 2000 the industrial and technological challenge*. CNPF-TEC & Cipta Kreatif. Completed with information from each of industry's official website.

These industries were a mix of old and new industries, some like PT BBI, PT Bharata, PT INKA, PT INTI, had a long history back to the colonial era. Three industries previously were under a military charge, i.e. PT IPTN, PT PAL and PT Pindad. Perum Dahana was formed under an offsets agreement in 1957 when the Indonesian Air Force procured surface-to-air missile.[41] PT Krakatau Steel was formed in 1967 using the remnants of the Trikora Steel Project built in the Soekarno era, under Soviet aid. PT LEN was created from an R&D centre, which used to be known as TELKOMA under the Indonesian Institute of Science (LIPI).

Aside from these industries, the state's R&D institutions had also been established. Lall notes that public sector institutions were divided between those under the Ministry of Industry and Trade (MOIT) and those under the MENRISTEKinstitutes; the latter being far more significant in terms of funding and scope of work. Under

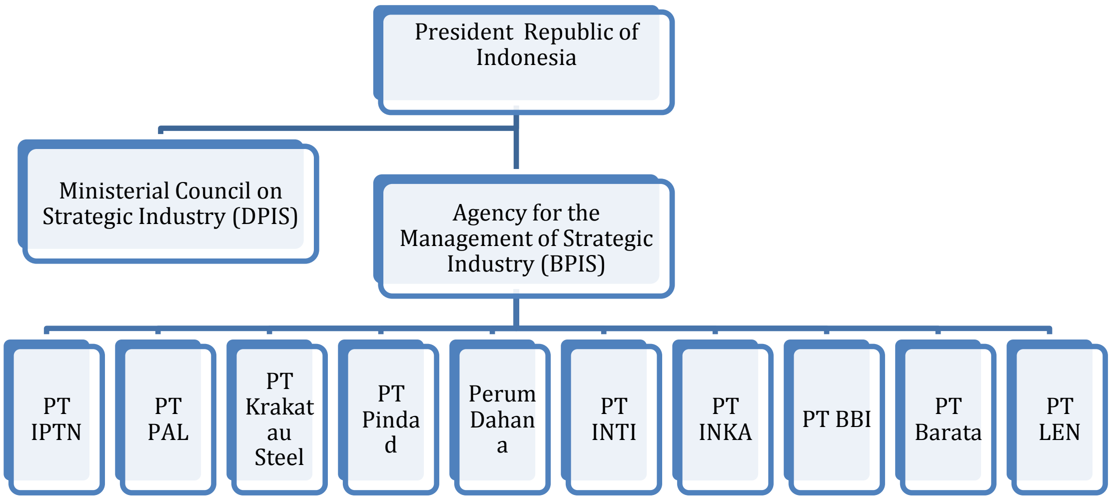
MENRISTEKwere six non-departmental government institutes, namely BPPT, Indonesian Science Body (LIPI), Central Bureau of Statistics (BPS), National Mapping and Survey Coordinating Board (Bakorsurtanal), National Institute of Aeronautics and Space (LAPAN), and National Atomic Energy Agency (BATAN). The Center for Research and Technology (PUSPITEK) in Serpong owns a number of labs and scientific research installations to support basic research and implementation through testing labs. Under MOIT there were 12 national level and several regional level R&D institutes, which managed a number of domestic and regional programme, such as providing technical service units focused on product design and engineering, process technology, management, and training.[42]

4.3.5 Management of Strategic Industries

The institutional arrangements for managing strategic industries were made to ensure that Habibie could exercise direct control over them and also the R&D institutions, answering directly to the President. The preparation for the strategic industries establishment was carried out through the Ministerial Council on Strategic Industries (DPIS) and the implementation of PMP was coordinated under the Agency for Strategic Industries Management (BPIS), both were sheltered under BPPT. Figure 4.2 shows the command line from the President through DPIS and BPIS, which ends at the strategic industries.

DPIS was established in 1983, and consisted of ministers from the Departments of Industry, Defence and Security, Communications, Finance, Tourism, Post and Telecommunications, and also the State Secretary, the State Minister for National Planning and the Commander in Chief of the Armed Forces. This council was tasked with coordination, administrative and managerial functions of the first eight strategic industries. Following what Habibie admitted as "a lengthy plan of almost 11 years", BPIS was established through Presidential Decree No. 44 in the Year 1989.[43] The state minister for Research and Technology, none other than Habibie himself, chaired BPIS. The organisation structure comprised four deputies: planning, economic and financial affairs, technological affairs, and administrative affairs. For this purpose, BPIS expanded its human resources from 141 in 1993 to 300 people in 1999 - more than double in the course of six years. The majority of staff have more bachelor degrees in social sciences (122) compared to that of science (9) and engineering (85); staffs with postgraduate degrees only amounted to 10 percent (34 out of 300) of the overall human resources in 1999. [44]

Figure 4.2 Institution Arrangements for Strategic Industry



Source: altered version from Raillon, F. (1990). *Indonesia 2000 The Industrial and Technological Challenge*. CNPF-TEC & Cipta Kreatif.

BPIS worked similarly under a holding company, mothering the then ten strategic industries by implementing integrated management, technical guidance and control. In detail, the Agency was authorised to manage, plan and oversee the implementation of programmes and production in the strategic industries; to manage, plan and oversee technology transfer and industrial transformation as well as to develop the strategic industries in integrative ways; to manage, plan and oversee efforts to develop wealth and the marketing of strategic industries. By the early 1990s, BPIS controlled ten SOEs strategic industries with around 43,000 employees.[45]

By the end of 1990s, BPIS had scored a number of successes.[46] First, it introduced and provided guidance for technology transfer through the PMP, determining the centres of excellence and parameters of product variation in the strategic industries. Second, BPIS determined the direction of strategic industry through coordination meetings held on a frequent basis. Third, it equipped the strategic industries with the tools of management. Fourth, it provided guidance and assistance in the formulation of long term planning of all strategic industries. Fifth, it formulated and conducted improvements in human resources in all the strategic industries. Sixth, it improved the professionalism of the strategic industries through discussion in the general meetings of shareholders (*Rapat Umum Pemegang Saham*, RUPS). Seventh, it was the command and control centre of every strategic industry and monitored their performance every month.

No less significant than DPIS and BPIS was the role of BPPT itself in safeguarding the development of the strategic industries. As the agency was in charge of technology assessment and applications, it retained massive authority and resources at its disposal. In addition to Habibie's centrality in BPIS as the head, BPPT as an institution delegated a number of its expert staff to strategic industries, some of who held strategic positions.[47]

4.3.6 The Strategic Industry

Among the unique features of accelerated industrialisation in Indonesia is the fact that the organisational framework chosen for the strategic industries was the SOEs. The Constitution 1945 Article 33(2) stipulates that the "Branches of production which are deemed vital for the state as well as affecting the interests of the nation will be managed by the state". Due to their strategic role, SOEs are protected from competition and, unlike the private sector objective, their objective is not solely to generate profits. Under the authoritarian and cronyism system of the New Order, there was the mind-set that the top-level positions in the SOEs is a matter of politics[48]. Lack of competition and the absence of meritocracy explain the character of SOEs that lean more to political considerations than professional values.[49]

There are three SOEs that focus on, but not exclusively limited to, the transportation sectors. These are PT IPTN (aerospace), PT PAL (shipbuilding), and PT INKA (rolling stock). The aerospace industry at the time was the most advanced in technological capability compared to the other two, having had the capability to design and produce aircraft since 1930s. In the post-independence era, President Soekarno endorsed the development of design and production capability with assistance from Eastern Europe. The first aircraft prototype was designed and produced in 1953 and by 1957 a trainer aircraft dubbed '*Belalang*' (grasshopper) was successfully built for Air force trainees. Following preparation to set up an aerospace industry, a department of aerospace engineering was established in 1963 in the Institut Teknologi Bandung, a prominent state university, and a number of university students were sent abroad to master aerospace technology. Unfortunately, the project was halted under the political turmoil that saw the fall of Soekarno.

A fully-fledged aircraft industry was finally realised in 1976, when IPTN was formed through the merging of the inventory of aircraft division of Pertamina and LIPNUR (*Lembaga Industri Penerbangan Nurtanio*). Hailed as 'the' model of progressive manufacturing plan and the 'technology spearhead', PT IPTN was the jewel of all strategic industries as well as the hallmark of Habibie's personal achievement. In addition to aircraft manufacture, the company also performed aircraft after sales service, maintenance, repair and overhaul as result of licensing and international cooperation.

Starting with around 500 workers and 17 engineers, PT IPTN multiplied its workforce to around 16,000 people by the early 1990s.[50] This expansion was obviously linked to the needs of the PMP. In retrospect, the company was the only strategic industry that managed to conduct all four stages of the PMP, where stages 2 and 3 were initiated only four years apart. The first stage was achieved through license production of the transport aircraft C-212 from Spain's CASA. Helicopters were license produced from Germany's MBB, France's Aerospatiale, and the US' Bell. In the defence sector, PT IPTN also license produced the SUT Torpedo from Germany's AEG Telefunken. The second stage was carried out through a joint venture with CASA, called Airtech, which became the outlet to jointly design and produce the CN-235 aircraft. Before the second stage concluded, the third stage was already embarked upon through indigenous design and production of the N-250 in which the latest technology, particularly 'fly-by-wire', was incorporated.[51] Again, the fourth stage was started before the previous stage concluded through indigenous design of the regional jet N-2130.

PT INKA initially started as a workshop for steam locomotive repair. It was established in 1981 over 20 hectares of land and supported by nearly 1,000 workers.[52] Stage one of the progressive manufacturing plan was achieved through assembly of bulk freight cars and passenger coaches licensed from, among others, Sumitomo Japan and Hawker Siddeley Canada. Stage two was kick-started with Holec/BN of the Netherlands/Belgium with electric trains. The company focused its business on the fabrication of railway cars, bogies, passenger coaches and the assembly of electric railcar, as well as the manufacture of forklift components and telephone exchangecontainers. In addition to manufacture, the company also had maintenance capability of rolling stock. In 1990, the company won a contract to manufacture container bogie cars to Malaysia valued at USD 3.8 million.[53]

PT PAL started as a ship maintenance and repair facility in the colonial era, being incorporated under the Indonesian Navy in the 1960s and located side-by-side with the eastern fleet naval base in Surabaya. PAL was made fully-fledged industry in 1980, occupying over 150 hectares of land with modern docks and facilities. To accommodate the PMP, six divisions (warships, commercial ships, general engineering, maintenance and repair, electronics and weapons, material) were formed. The company grew its employees to around 6,000 in the 1990s.[54] Until the end of the 1990s, PT PAL succeeded in progressing through three stages of the PMP. The first stage was carried out through license production of both commercial and defence products. License production of Fast Patrol Boat 28 and Fast Patrol Boat 57 was acquired from the Belgian Ship Corp and Germany's FR Lursen. The second stage of PMP was achieved through joint design with Mitsui Japan on 3,000 and 3,500 DWT tankers dubbed '*Caraka Jaya*', which were indigenously manufactured in cooperation with five other shipbuilders in Indonesia.[55] The third stage of the PMP was secured through the indigenous design of a container ship, dubbed '*Palwo Buwono*'.

Communication and electronics sectors, represented by PT INTI and PT LEN, were considered as producers of strategic transportation for the integration of an archipelagic country and for national resilience. PT INTI started as a post and telecommunication laboratory in 1926, became an R&D institute under the Ministry of P&T, and finally transformed into a telecommunications industry with support from Siemens Germany. Starting with 500 employees, the company owned three support centres for training, computer activities and R&D.[56] Similar to PT INTI, PT LEN was also created from an R&D centre, which used to be known as TELKOMA under LIPI. Located in Bandung, the company employed around 700 employees mostly with degrees from university.[57] LEN became an SOE in 1991 and joined other strategic industries under BPIS.

PT INTI and PT LEN were quick to expand technological capability, owing to their strong R&D culture and highly skilled workers. PT INTI started stage one through a license agreement with Siemens, Japan Radio Company and Nippon Electric Company, which also provided training and technical assistance. Stage two was conducted through cooperation with Siemens Germany.Entering 1990s, the company scored export of a small earth station to Malaysia.[58] At the time the company's annual production capacity included 55 Siemens' digital telephone switching exchanges, 166,000 units of standard desk telephones, 3,000 units of public payphones, marine radio equipment, small satellite earth stations, digital PABX, mobile telephone systems, and much more.[59] Within 15 years, PT INTI managed to quadruple its workforce from around 500 to more than 2000 people.[60] PT LEN recorded even more impressive progress. The company kick-started stage one through the development of hybrid and IC, moved up to stage two through the development of small earth stations, and achieved stage three through the production of relay TV.

The fifth, sixth, and seventh vehicles of industrial transformation (energy, engineering, and agricultural machinery) were represented by PT BBI and PT Bharata.[61] PT BBI was started as the result of a merger between three Dutch companies, NV de Bromo in Pasuruan, NV de Industri and CV de Vulkaan in Surabaya, which were nationalised in 1958 and renamed as PT Boma, PT Bisma, and PT Indra. The three were merged in 1971 and retained their location in Surabaya. In 1974, a license agreement was agreed with Netherlands' Stork Werspoor Sugar to develop capability in designing, manufacturing, and completing the construction of a sugar factory, steam boiler and pressure vessel.[62]

PT BBI joined the strategic industries rather late in 1998. Stage one of the PMP was started through a number of cooperation agreements, including KHD Germany in diesel machines, Hamon Sobelco Belgium in industrial tools (energy, paper, cement, petro chemical), Pertamina in oil and gas, and PT KEC in cement. The company focused its business on heavy machinery, machines, metal casting, construction, machinery installation services, and maintenance of factories. By the early 1990s the company supported 2,000 employees in 14 branches across 10 cities in Indonesia (Java, Sumatra, and Borneo).[63] Its annual production capacity amounted to 6,000 diesel machines, 25,00 construction plates, engines and factory equipment, and 1 million units of various agricultural equipment and fabricated tools.[64] The company recorded exports to the US of 13,500 containers across 1989 and 1990.[65]

PT Bharata, similar to PT BBI, also specialises in heavy equipment manufacturing, construction, and engineering. The company started as a merger between NV BRAAT Machinefabriek, a company manufacturing bridges and another steel construction firm, PN Sabang Merauke (previously Machinefabriek & Scheepswerf NV Molenvlict in 1920) engaged in the restoration of budidaya gunung dan perkalapan pantai, and PN Peprida (1962), a state owned company created to work on the development of basic industries (PT Barata, 2014).[66] With its central office located in over 22 Ha in Gresik (previously in Surabaya), PT Bharata has infrastructure spread across 10 areas.[67] PT Bharata started in stage one PMP through cooperation with Germany's ABD&Werber producing pressing machines, with Yugoslavia's Rudnap producing tractor dozers, and Japan's Kobelco building excavators. By the early 1990s, the production capacity for heavy machineries as high as 810 units per year.[68] The company employed around 3,000 workers in 1993.[69]

The eighth vehicle, defence industry, was represented by PT Pindad. It started life as Artillerie Constructie Winkel in 1808. Pindad was incorporated under the armed forces in the 1960s to perform maintenance of artillery and produce small calibre ammunition. Pindad succeeded in the local production of assault rifles but never made it to mass production scale. By 1983 it was taken out of the Army's control and became a fully-fledged industrial concern.[70] Stage one of the PMP was carried out through a number of cooperation deals in both the defence and commercial sector. License production of the SS1 riffle was acquired from FN Herstall Belgium. License production of light and heavy ammunition was agreed with Germany's Fritzwener and Salgaduk, respectively. In the commercial sector, Pindad agreed cooperation with Siemens to produce generators, with Taiwan's YAM and Yeong Chin to produce machine tools, and with Germany's Thyssen RH to produce forging and casting products. Starting in the 1990s, PT Pindad exported to several countries in the region, such as Malaysia, Singapore, Thailand, and Brunei, which amounted US$ 5 million, equal to two percent of its total production.[71]

PT Krakatau Steel and PT Dahana are among the supporting industries. PT Krakatau Steel was formed in 1967 using the remnants of the Trikora Steel Project from the Soekarno era, which was part of the Soviet Union's aid at the time. Stationed in Cilegon, West Java, PT Krakatau Steel employed more than 7,000 workers to produce sponge irons, steel slabs, billets and wires for shipbuilding;exports were made to Japan, including automotive parts.[72] PT Krakatau Steel had moved from stage one (technology adoption), through cooperation with Hylsa Mexico on sponge iron, to stage two, through indigenous development of corten iron steel.

PT Dahana, initially Perum Dahana, was created through an offset project called 'Project *Menang*' (named after a village where the factory was built in East Java - in *bahasa Indonesia* this also means victory) to assembly missiles. Diversification into explosives manufacturing occurred, which later became the company's business focus. In 1966 the factory was relocated to Tasikmalaya in West Java. The first stage of the PMP was conducted through Indigenous development of geodin and demotin dynamite and cooperation with ICI Australia on water based emulsion. Stage two was conducted through cooperation with Oil Tech Argentina on product shape charges.

Table 4.2 below shows the stages of PMP achieved by each of the strategic industries by the mid of 1990s. PT IPTN was remarkably ahead of other industries, with PT PAL and PT LEN coming second at the third stage of PMP. PT Dahana, PT INKA, and PT INTI were at the second stage, whereas PT BBI, PT Bharata, and PT Pindad were still stuck in the first stage of PMP.

Table 4.2 Technological Progress in the Strategic Industries Based on Stages in Progressive Manufacturing (1983-1993)

SOEs	Stage in Progressive Manufacturing			
	1st stage	2nd stage	3rd stage	4th stage
PT IPTN	• License production • CASA 212 with Spain • NBO 105 with MBB Germany • NAS 332 and NAS 330 with Aerospatiale France • NBell 412 with Bell USA • SUT Torpedo with AEG Telefunken Germany	CN 235 through Joint Venture with CASA	N-250	N-2130
PT PAL	• License production FPB-57 with FR Lursenw Germany • FPB-27 with Belgian Ship Corp • Boeing Jet Foil with Boeing USA	Joint design, indigenous manufacture with Mitsui Japan on tanker 3500 DWT and Caraka Jaya III 3000 DWT (merchant ship)	Palwo Buwono	NA
PT Pindad	• License production SS1 with FN Herstall Belgium • Light ammunition with Fritzwerner Germany • Heavy ammunition with Salgaduk • Generator with Siemens Germany • Machine tools with YAM and Yeong Chin-Taiwan • Cast product with Thyssen RH-Germany	Indigenous design of SS 1 assault rifle, Indigenous design of land system	NA	NA
PT Dahana	• Indigenous development of geodin and demotin • Cooperation with ICI Australia on waterbased emulsion	Cooperation with Oil Tech Argentina on product shape charge	NA	NA
PT Krakatau Steel	• Cooperation with Hylsa Mexico on sponge iron	Indigenous development of corten steel iron steel	NA	NA

SOEs	Stage in Progressive Manufacturing			
	1st stage	2nd stage	3rd stage	4th stage
PT INKA		Cooperation with Sumitomo Japan on gerbong barang dan passenger train Coperation with Holec/BN-The Netherlands/Belgium on electric train	NA	NA
PT INTI	• Development of STDI, public phones, small earth stations	Cooperation with Siemens Germany on STDI-K	NA	NA
PT BBI	• Cooperation with KHD Germany on diesel engine • Industrial tools (energy, paper, cement, petro chemical) with Hamon Sobelco Belgium on boiler • Pertamina on oil and gas • PT KEC on cement industry	NA	NA	NA
PT BARATA	• Cooperation with ABG&Werber Germany on tandem roller, Rudnap Yugoslavia on tractor dozer, Kobelco Japan on excavators • Development of industrial tools such as steel structure, paper mill component, boiler and turbine for sugar mill and energy industry, high grade cast iron and steel	NA	NA	Na
PT LEN	• Development of Hybrid & IC	Development of SBK (small earth station)	TV transmit ter	NA

Source: Subekti et al (eds.) (1993) *Teknologi di Indonesia*. Teknologi Indonesia. Updated with additional data from fieldwork in PT DI, PT Pal, and PT Pindad April 2014- August 2015.

4.4 Development of Defence for Development

4.4.1 Dual Use Industrialisation: The Technology Spearhead

Habibie's trail of thought on strategic industrialisation and the progressive manufacturing plan coincided with a number of other events, serving to support his case of a dual-use portfolio approach to the development of the strategic industries. The **first** event was military modernisation that was planned to kick-start in the early 1990s, paving the way for major acquisitions on a big scale. **Second**, the shrinking access to western military technology was subsequently followed by a growing negative sentiment against dependency on foreign arms, which drove the need for self-sufficiency in arms provision.

Defence procurement in Indonesia possessed distinctive politico-military conditions[73], which reflected the unique features of its foreign policy and national interest, the absence of a professional military, and the lack of democratic control over its armed forces. Indonesia's foreign policy was free and active, which eliminated the possibility of alliances and burden sharing in defence. [74] Threat perception, mission, influence of foreign policy on arms procurement, and dependency on foreign arms, all strengthened the inclination to secure strategic sovereignty. Following this logic, import substitution of arms should have become a mutual interest of the military and the engineers. However, the dual function of the military (socio-political role) also meant that the institution held privileges over some areas in which civilian oversight was absent, arms procurement being one example.[75] Arguably, this privilege was responsible for the 'clash of interests' between the military as the user and the engineers when it came to the imperative of offset in determining arms procurement contracts, whether it was due to arms import being a lucrative business for kickbacks, where the role of third parties or 'brokers' operated[76] or other more strategic considerations. Hence, the defence procurement system at the time was not really enthused by the idea of participating in domestic arms provision.

The above predicament became significant when the Indonesian armed forces (*Angkatan Bersenjata Republik* Indonesia, ABRI), which at the time consisted of an army, air force, navy, and the police, rose as a political actor with considerable influence. The unusual arrangement to unite the armed forces and police under one roof monopolised defence and security under one state agency. This explains why ABRI had the authority to respond to a vast spectrum of threats from the "low intensity threat, such as criminality, sabotage, terror and subversion", to "high intensity threats, such as armed separatism, limited and open war by conventional and also weapons of mass destruction"[77]. ABRI's dual use doctrine put emphasis on internal security and stability as the precondition for development, and was translated into a social political role, from representation in parliament to strategic positions in political and economic entities. The appointmentof ABRI's personnel to positions disconnected from their core expertise is allegedly responsible forthe abandoning of ABRI. Regardless of ABRI's considerable influence in Indonesian politics, the institution suffered from under-management and under-financing.

As a consequence of the state's prioritisation of economic recovery under Soeharto's administration in 1966, defence development was not started in parallel with the first five-year development plan. Repelita I (1968-1973) focused on meeting the people's basic needs, and therefore defence sector development took secondary priority and was pushed back to Repelita II. While ABRI had suffered from deterioration in equipment, logistics, and education as a consequence of constant deployment under the previous administration, the combination of benign external and internal conditions allowed ABRI to undertake consolidation and rehabilitation.[78] The Soviet's decision to terminate arms and spare parts provision to the new administration in Jakarta created a significant gap in defence readiness, but this was soon remedied by grants from western countries.

The first defence development policy mandated in RENSTRA HANKAM I (Strategic Plan on Defence and Security) under Repelita II (1974-1979)[79], aimed to achieve a small but efficient ABRI that was able to expand rapidly under the emergency[80]. Small budget flexibility for development meant investment in material was constrained to extending the life cycle of weapon systems through renovation, rehabilitation and refit. Early defence procurement was undertaken through a combination of second-hand equipment purchases and grants, as well as limited procurement of mostly western technology. This policy basically continued through RENSTRA HANKAM II (1979-1983).

It was only under RENSTRA HANKAM III (1984-1988) that real defence modernisation finally began to receive serious attention. Additional maritime territory and air space as a result of UNCLOS[81] and lengthy military campaigns in East Timor[82] were among the factors that shaped the requirement of defence missions and boosted the responsibility of the armed forces. There was also urgent development of capability that included national air defence, strategic transport, territorial control/surveillance, and security of the Exclusive Economic Zone. For the first time, self-sufficiency in weapons provision was deliberate, with the priority shifted to development of new air force and naval bases outside Java. The Plan also raised the need for industrial development to produce light weapons, explosives and ammunition, military optics, communication electronic devices and other simple technology that could be produced domestically.[83]

4.4.2 Dual-use industrialisation: From Defence to Development

Dual use production policy was made formal through the 1983 GBHN (State Policy Guidelines) chapter IV on Defence and Security, which mandated that modernisation of arms must uphold the utilisation of domestic production for dual purposes. Furthermore, RepelitaIV (1984-1989) stipulated that the mission of the Defence and Security Industry (DSI) must be expanded to include the economy, technology, and defence[84]. In other words, strategic industries must be able to create multiplier effects, conduct progressive manufacturing plans, and fulfil both commercial and military demand (dual-use). It was not a coincidence that the obligations to fulfil these three roles fell to the strategic industries with dual use production - namely PT IPTN, PT PAL, and PT Pindad - the top three recipients of government investment,[85] led directly by Habibie.

Initially dual-use production was applied toindustry that only produced arms, that is PT Pindad. According to Habibie, diversifying business to commercial activities would serve to reduce the cost of industrial development due to limited domestic demand, mostly came from government and the Armed Forces. For this purpose, a formula was formalised for the appropriate ratio of production capacity in peace and war. It was expected that in peacetime, the ratio would be 80:20 for commercial: military, which would be reversed in war.[86] For PT Pindad, this meant creating divisions of forging, casting, industrial machinery and services. The same formula was then applied to PT IPTN and PT PAL; in the latter justifying the creation of a warship and weapons integration division.

Other strategic industries played the role of supporting industries in dual-use industrialisation. As early as 1979, BPPT had conducted a study on how non-defence industries could support arms production, especially in the manufacture of light weapons.[87] The study extended to other areas, such as engaging PT Bharata in the production of track shoe prototypes for PT-76 amphibious tanks in 1981. The push for supporting industries in the dual use industrialisation programme continued, among others, with PT Krakatau Steel supplying steel for shipbuilding in PT PAL as well as other shipbuilding activities in Indonesia, including PT Dahana supplying explosives for military purposes, and PT INTI developing capability for the installation of fire fighting systems on the navy's ships.

BPPT also played a vital role in the planning of dual use industrialisation. BPPT conducted a study in 1984/85 on defence and security issues at national, regional, and international levels that affected the country's national interest in the short, medium, and long term. Based on this information calculation were made on the types and numbers of defence equipment required for each service in the Armed Forces until 2005. This list of requirements was used as a reference for strategic industry development planning.[88]

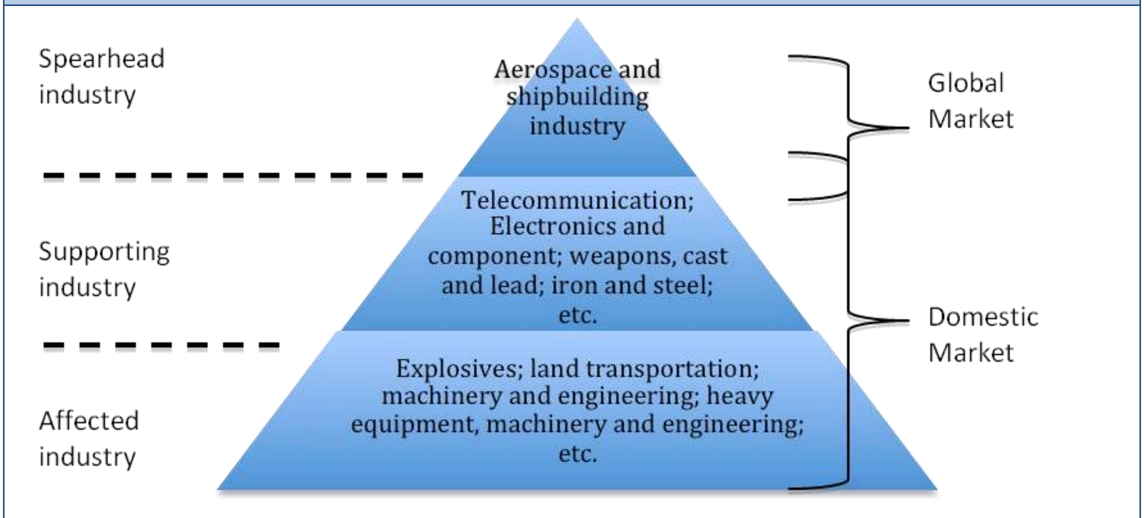
Linked to the dual use model is the concept of a technology spearhead and industry hierarchy. Since the beginning, Habibie had stated that trickle down or multiplier effects were expected from the eight industries to create a 'tangible nineth industry'. For this purpose, he focused on two industrial sectors, aerospace and shipbuilding, to be the technology spearheads to ensure the creation of multiplier effects. Figure 4.3 below describes the hierarchy in strategic industries and how spill over effects could stimulate the development of supporting industries (*industry pendukung*) and the emergence of affected industries (*industry terimbas*).

This industrial hierarchy placed the most burden on aerospace and shipbuilding industry to create multiplier effects. PT IPTN as the only aerospace industry had to be able to compete in the global market through exports, and create enough demand for local supply chains to grow. According to Habibie (1978)[89]:

> "When the Nurtanio industry (later renamed IPTN) can hire 10,000 workers with international standard at one time, it will give benefits to others… by opening opportunity for subcontracting business in electronics, avionics,… which means the aerospace industry can provide multiplier effect."

PT PAL as the biggest shipbuilding industry must also be competitive globally, while at the same time encourage local supply of raw materials like steel and paints. The two industries were equipped with massive investments and top-notch facilities, such as computers and training, which could be accessed by other industries and higher education institutions.[90]

Figure 4.3 Strategic Industry and Spill over Effects



Source: BPIS (unpublished)

The strategy of the progressive manufacturing plan through strategic industries therefore served a dual-purpose: for development, through the creation of value-added, employment, and skill enhancement, and for defence, through the creation of defence value chains that consisted of spearhead industries and supporting industries. This dual-purpose industrialisation resonated with high ambition, but the real purpose was actually to ensure the optimisation and dissemination of scarce resources through military expenditures could be enjoyed by other sectors as well.

4.5 Summary: The Challenge of Technology Development

This chapter has outlined the tapestry of Indonesia's technology development and industrialisation from the independence era until the end of Soeharto's New Order. While the first industrialisation effort under Soekarno laid the foundation for manufacturing, it was under Soeharto that the industrialisation aimed at 'catching-up'. This was done through a great experiment using strategic industries as vehicle for progressive manufacturing. The preconditions are captive market and technological capability to climb up ladder of production. In order to guarantee these, government used public procurement and transfer technology from abroad. Arms procurement provided the opportunity to enlarge the captive market for strategic industries, as well as to generate technology transfer from offset. This serves as the pretext for evaluating the role of offset in arms procurement that will be discussed in chapter five.

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2 Technocrats in Bappenas strongly believe in comparative advantage, while engineers in BPPT believe in competitive advantage through accelerated industrialisation. According to an interview in April 2014, BPPT and Bappenas are complementary and not competing. However, many literatures suggest otherwise, pointing out the fact that the engineer and technocrat under New Order did not get along well. Habibie himself expressed his impatient and irritation to the technocrats's orthodox approach to economic development. See Elson, R.E. (2007) 'Engineering from within: Habibie the man and Indonesia's Reformasi', in: *conference on Indonesia's reformasi: reflections on the Habibie era*, SAIS, 26-27 March 2007. See also Amir, S. (2008) 'The Engineers Versus the Economists: The Disunity of Technocracy in Indonesian Development', *Bulletin of Science, Technology, and Society*, 8(4).

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4 Wie, T.K. (2010) 'The Debate on Economic Policy in Newly-independent Indonesia between Sjafruddin Prawiranegara and Sumitro Djojohadikusumo', *Itinerario* , 34(1).

5 Wie, T.K. (ed.) (2003). *Op.Cit*.

6 Programme Benteng was aimed at creating resilient national businessperson and put import under government control. This was done through giving import license to national businessperson. The programme failed because the license was sold to foreign businessperson, predominantly the Chinese, hence creating a rent economy.

7 The plan could only go as far as building few industrial plants due to bad organisation, incompetent management, cumbersome government administration and financial regulations, and lack of technical experts. Wie, T.K. (2010) *Op.Cit*..

8 See Wie, T.K. (ed.) (2003) *Op.Cit*.

9 Wie, T.K. (1994). *Industrialisasi di Indonesia: Beberapa Kajian*. Jakarta: LP3ES.

10 Kuncoro, M. (2007). *Ekonomika Industri Indonesia, menuju Negara industry baru 2030?*. Penerbit Andi.

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15 15 January Tragedy refers to student demonstration and riot that took place 15 to 16 of January 1974 in Jakarta to protest state visit of Japanese Prime Minister at the time. Available at: https://en.wikipedia.org/wiki/Malari_incident (Accessed October 2015)

16 Shiraishi, T (1996). *Ibid*.

17 See Makka, A.M., (2010).*Jejak Pemikian B.J Habibie: Peradaban Teknologi Untuk Kemandirian Bangsa*. Mizan Pustaka.

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22 Kuncoro, M. (2007). *Op.Cit.*

23 In 1993 Indonesia invested around 0.2 percent of GDP in R&D, in which the government provided 80 percent of the funding.

24 Lall, S. (1998) in Hill, H. and Wie, T.K. (eds.). *Op.Cit*.

25 Hill, H. and Wie, T.K. (eds.) (1998). *Op.Cit*.

26 President Soeharto had direct access to Pertamina, state's oil company, which is the biggest contributor of state budget at the time. Under the regime, legislative serves as rubber stamp only due to the fact that majority of MPs are selected by President and lacking in supporting system to carry out the budgeting task. As told by in a discussion with a former minister and technocrat under Soeharto regime in Singapore, 2011. For more discussion on the role of Pertamina in Soeharto's early periods, see Abdulgani-Knapp, R. (2007). *Soeharto: The Life and Legacy of Indonesian Second President*. Marshall Cavendish International.

27 See Hill, H. and Wie, T.L. (eds.) (1998). *Loc.Cit.*; Elson, R.E (2007). 'Engineering from within: Habibie the man and Indonesia's Reformasi'. In: *The conference on Indonesia's reformasi: reflections on the Habibie era*, SAIS, 26-27 March 2007; Amir, S. (2008), *Op.Cit.*

28 Elson, R.E. (2007). *Op.Cit*.

29 Interview: A1, Jakarta, Fieldwork Research (April 2014).

30 Habibie, B. J. (1995). *Ilmu Pengetahuan, Teknologi & Pembangunan Bangsa*. Jakarta: Cides. Part of this speech that explained his concept of progressive manufacturing plan, technological spearhead, and strategic industries were reintroduced over and over again throughout 1980s-1990s. Among others, see Habibie's speech at Universitas Tarumanegara, 26 July 1986; Habibie's speech in Conference Pacific 2000: Global Challenge held by the International Herald Tribune, Singapore, 11-13 November 1987; Habibie's speech in national seminar on high technology for economy take off, Ujung Pandang, 14-15 June 1988.

31 Habibie argued that there are two aspects of value added production: value added and cost added. The process aimed at optimising the valued added of material and component, while at the same time minimise cost added throughout the chain of activities from product development, production, until positioning the product in market. He listed aerospace and shipbuilding industries as among those producing the highest value added. See Habibie, B.J. (1995). *Ibid*.

32 Habibie, B.J. (1995) *Ibid*.

33 Progressive Manufacturing Plan is coined by Habibie to refer to four stages of economic transformation based that he admits to be a kind of reverse engineering. See Habibie, B.J. (1995). *Op.Cit*.

34 Habibie, B.J. (1995) *Ibid*.

35 Raillon, F. (1990) *Op.Cit*.

36 Chaniago, A. (1990). *Masalah Pengalihan Teknologi Amerika Serikat untuk Pengembangan Industri Strategis di Indonesia*', Unpublished undergraduate thesis, University of Indonesia. See also 'Free Import Trade System For Industries',*BBC Summary Of World Broadcasts*, 7 January 1987.

37 Habibie, B.J. (1983) 'Some Thoughts on Industrial Transformation Strategy of Developing Country'. *Presentation inDeutsche Fur Luft-und Raumfahrt*,Bonn, 14 June 1983.

38 *Ibid*.

39 *Ibid*.

40 It was generally known that the criteria of strategic strategy was never made clear. Habibie himself acknowledged that strategic industry was determined solely by the president. See, Habibie, B.J. (1989) speech at the inauguration of BPIS first echelon officials, Jakarta, 3 November 1989.

41 Interview: A1, Jakarta, Fieldwork Research (April 2014).

42 This was targeted at five type of industry: food and beverages, clothes and leather, chemical and contraction material, handicraft and general industry, as well as metal. Lall, S. (1998) 'Technology Policies in Indonesia' . In: Hill, H. and Wie, T.L. (eds.). *Op.Cit*.

43 Habibie's speech at the inauguration of BPIS' first echelon officials, Jakarta, 3 November 1989.

44 Undergraduate here refers to S0/D3 and S1 level in Indonesia. Data are taken from Trenggono, N. (n.d.) 'Budaya organisasi: studi tentang nilai-nilai dalam kinerja komunikasi Badan Pengelola Industri STrategis (BPIS). *Undergraduate thesis, Universitas Indonesia*. (Unpublished)

45 Raillon, F. (1990). *Op.Cit*.

46 Trenggono, N. (n.d.). *Op.Cit.*

47 This practice continues until today although the number has decreased. The position includes executive director, director of finance, etc.

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49 As comparison, in 1993 the total asset of 300 private conglomerates is IDR 227 tr and control 63.61 percent omzet. While SOEs control total asset of IDr 267 tr and 31.71 percent omzet. By 1997, out of 160 SOEs under Ministry of SOEs, 53.8 percent are underperforming. These indicators prove that SOEs are low in Return on Investment and Return in Equity. See Nugroho, Ryan, and Wrihatnolo, R.R. (2009). 'Pengalaman Revitalisasi BUMN'. Citing Internet resources (www document) www.bappenas.go.id (accessed May 3, 2014)

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53 Raillon, F. (1990). *Op.Cit.*

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56 Raillon, F. (1990). *Loc.Cit.*

57 Raillon, F. (1990). *Loc.Cit.*

58 Raillon, F. (1990). *Loc.Cit.*

59 Raillon, F. (1990). *Loc.Cit.* p.154.

60 Raillon, F. (1990).*Loc.Cit.*

61 Later on, other industry such as PT PAL and PT Pindad also jump into engineering and energy sector. PT Pindad received offset in generator from Siemens and scored export to Africa.

62 Company Profile PT BBI. Available at http://www.ptbbi.co.id/history.html (accessed in December 2014)

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64 Raillon, F. (1990). *Op.Cit.* p.102

65 Subekti et al (eds.) (1993). *Op.Cit*

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68 Raillon, F. (1990). *Op.Cit*

69 Raillon, F. (1990). *Loc.Cit*

70 Company profile PT Pindad. Available at www.pindad.co.id. (Accessed in December 2014)

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72 Raillon, F. (1990). *Op.Cit*

73 Politico military variable is part of methodology used by SIPRI to investigate arms procurement decision-making in ten countries. See Singh, R.P. (1998). *Arms Procurement Decision Making.* SIPRI.

74 Regardless of the foreign policy, in reality Soekarno administration tended to lean on eastern block for weapons supply while Soeharto administration did the opposite and instead dependent on the US and its allies for weapons.

[75] On the extent of ABRI's privilege in self-funding through military business and corruption surrounding arms procurement see Iswandi (1998). *Bisnis Militer Orde Baru: keterlibatan ABRI dalam bidang ekonomi dan pengaruhnya terhadap pembentukan rezim otoriter*. Penerbit Remaja Rosdakarya.

[76] Agents or brokers refer to those who have knowledge in military technology and ability to provide overhead cost of arms procurement. This overhead cost is later incorporated into procurement cost, hence creating mark up. Under New Order, broker entered the arms procurement policy making through, among others, Soeharto's own children. See 'Pengadaan Alutsista- Keterlibatan Agen Senjata Sulit Dihindarkan', 19 Maret 2012, http://beritahankam.blogspot.com/2012/03/pengadaan-alutsista-keterlibatan-agen.html(Accessed in December 2014);'Tank sale to Suharto's Indonesia was mired in corruption', *the Guardian*, 9 December 2004

[77] Mabes ABRI, *Postur Angkatan Bersenjata Republik Indonesia dalam Pembangunan Jangka Panjang 25 Tahun Tahap II Tahun 1994-2018*.

[78] Repelita III, Renstra Hankam II 1979-1983. As relationships with neighbouring countries were vastly improved through the establishment of regional architecture Asean in 1967, there was no imminent military threat facing Indonesia.

[79] The development plan in defence was formulated in defence-security strategic plan (*Renstra Hankam*), where each strategic plan was issued for each phase of *Repelita* or five years development planning (*Rencana Pembangunan Lima Tahun*). For the longer term, the long-term development plan (*Rencana Pembangunan Jangka Panjang*) was created for a period of 25 years or five Repelita. However, *Renstra Hankam* was only explaining the general plan and not going into detail of the program. Another document that stated the modernization plan in detail was "ABRI's Posture within the second long term development plan year 1994-2018" issued by military headquarter.

[80] 'Renstra Pertahanan Keamanan', Chapter XV, *Repelita* I (1969-1974).

[81] Following the acceptance of UNCLOS 1982, Indonesia's maritime territories and air above it have increase tenfold. See, Hasjim D. (2014), 'The Management of Maritime Boundaries and Border Areas of Indonesia', Indonesian Defense University Journal.

[82] See Leonard, S. (2006). *Realpolitik Ideology: Indonesia's Use of Military Force*. ISEAS.

[83] 'Renstra Pertahanan Keamanan', Chapter XV, *Repelita* IV (1983-1978).

[84] Habibie, B.J. (1995). *Op.Cit*.

[85] PT PAL and PT Pindad received investment amounted to IDR 292,90 bn and IDR 48,81 bn respectively. See Chaniago, A. (1990). *Op.Cit.*

[86] Shiraishi, T.(1996). *Op.Cit.*

[87] *15 Tahun BPP Teknologi 1978-1993*. Penerbit BPPT.

[88] *Ibid*.

[89] Habibie mentioned about multiplier effect in his speech entitled 'Technologi dan Pembangunan' (Technology and Development), delivered in front of participants at School of Armed Forces Combined Command and Staff College, Bandung, 3 February 1978.

[90] Rouillon, F. (1990). *Op.Cit.*

5. THE CONTRIBUTION OF OFFSET TO INDONESIAN DEFENCE INDUSTRIALISATION

5.1 Introduction

Indonesia presents a worthy case study of offset on several counts. First, the country is hailed as the pioneer of direct offset in the Southeast Asia region,[1] and the first major country outside of Eastern Europe to adopt a countertrade policy[2]. Second, given its status as a latecomer, the country sought technological progress since the 1970s to expedite the process of industrialisation. The government selected industrial champions and used offset as a means for technology transfer, as well as to gain international recognition essential to enter the global market. Third, offsets have been applied to both commercial and defence procurement and channelled to strategic industries, with a dual-use portfolio, particularly in the aerospace and shipbuilding sectors. This has enabled the strategic industries to climb up the ladder of production, as described in the previous chapter.

Offset certainly has its appeal in Indonesia. The country has seen the emergence, disappearance, and reappearance of offset during the course of strategic industrialisation in the 1980s, the economic crisis in the late 1990s, and during the defence industrial revitalisation programme in the 21st Century. Offset keeps on returning, whether as an official policy or as an informal practice. The latest example is the adoption of the 2012 mandatory offset policy for the purpose of defence industrial revitalisation. However, the question remains as to what exactly has been the contribution of offset, and does it merit a special place in the country's defence industrialisation efforts today?

This chapter seeks to assess the role of offset in defence industrialisation policy in Indonesia. For that purpose, it is necessary to locate offset within the evolving practise of countertrade, and to gain an understanding how offset is perceived, regulated, and utilised. This chapter will be structured as follows: section 5.2. explains how offset has gradually taken centre stage in strategic industrialisation; section 5.3. provides an overview of offset programmes in Indonesia across three different industrialisation periods: (1) during 1988 to the late 1998 when offset was used to support development of strategic industries; (2) during 1999-2009 when offset was used to help survival of the ailing strategic industries; and finally (3) 2010-2014 when offset is used to support revitalisation of strategic industries; section 5.4 analyses offset via the case studies of PT DI, PT Pal, and PT Pindad that represent defence industry in aerospace, shipbuilding, and land systems;section 5.5 moves on to establish whether offset has worked, looking at six variables in which offset has the potential to contribute to defence industrialisation: employment, skill-enhancement, technology transfer, export, value chain creation and R&D; and, finallysection 5.6 examines the implications of offset on Indonesia's defence industrialisation strategy.

5.2 From Countertrade Roots to High Technology Offset

The earliest record of countertrade regulation in Indonesia showed that offset is rooted in early post-war government policy. The first known countertrade policy was issued in 1952, entitled "Hong Kong Compensation Trade", which allowed those who exported commodities to Hong Kong to accept imports of commodities from Hong Kong in return, at the same value.[3] Barter was also conducted with socialist countries such as the Soviet Union, Poland, Yugoslavia, and East Germany. The close bilateral relationship with the Soviet Union in the late 1950s provided Indonesia with handsome compensation when purchasing military equipment, which included modern weapons, such as MiG-21 fighters and SA-76 rockets. As mentioned previously in chapter four (see p.20), the Indonesian explosive manufacturer PT Dahana was born out of an offset arrangement with the Soviet Union.[4]

Countertrade practices were banned in 1971 by the then Minister of Trade, Sumitro, who believed that it actually did more harm than good to Indonesia.[5] By the early 1980s, countertrade had returned following the economic crisis that accompany falling oil prices. High reliance on petroleum exports inflicted a massive deficit on the government budget. The Indonesian government issued an emergency policy entitled the 1982 January Package[6] to address the deficit as well as to boost the export of non-petroleum/gas products[7] and non-traditional commodities to non-traditional markets. A subset of this regulation is the countertrade policy - encompassing offset, compensation, and buy-backs [8] - which Parsons hailed as "perhaps the first comprehensive and legally codified countertrade policy ever instituted outside the socialist nations"[9]. The institutional framework was simple: the Ministry of Trade was in charge with counter purchase, while the arrangement of offset, compensation, and buy-back was assumed by the ministry in charge of procurement.[10] Countertrade practices continued throughout 1982-1997, during which an average of 36 projects were conducted every year at a value of USD 478 million[11]. However, the absence of documentation made it impossible to determine the extent to which offset might have been implemented under the countertrade regulation.

Offset gradually took centre stage, as Indonesia progressed industrialisation under President Soeharto. It was arguably driven by the increasing power of the engineers in directing the country's microeconomic planning – specifically in technology adoption - and providing the stamp of approval for government procurement.[12] The earliest mention of offset as a concept can be traced back to 1978, in Habibie's speech at *Sekolah Staf Komando Gabungan* (Joint Command and Staff College) entitled "Technology in Development".[13] He suggested that procurement practices should not only focus on price or added cost but also on local participation in production, which can pave the way for technology transfer. Habibie explained to his audience that a common practice in aircraft sales is that part of the payment is made in man-hours, not in cash *per se*. However, this is possible only when the buyer is recognised for its ability to produce parts at international standards. The benefit of this is to provide jobs and to save foreign currencies that otherwise would flow out.

Again in 1982 Habibie mentioned offset in his speech entitled "Science and Technology and Nation Building" in front of the *Keidanren,* Tokyo. He said

> "… Captive market for vehicles, transportation and communications is huge. Import of these goods can be financed partly by export of energy, raw material, agriculture products and others… But at this level of development, part of the (procurement) cost can be financed, perhaps up to 50 percent, by local production through 'offset arrangements'."14

He defined offset as an "agreement to import certain goods on condition that some of the components will be produced in the buyer country". The objective is to reduce the cost of importing industrial goods. Already Habibie referred to offset as 'a real possibility' because of the precondition he mentioned before in 1978 that a certain level of development of domestic industry must exist. PT IPTN, for example, had succeeded in license production of the C212 transport aircraft and was ready to climb to stage 2 of the PMP through a joint venture with Spain CASA to jointly design a medium transport aircraft for 35 passengers (see chapter four p.17). This means that the aerospace industry had the capability to produce components of aircraft to meet international standards.

Among early implementation of offset under Habibie's era was the government's procurement of civilian technology. For example, technology transfer in the procurement of satellites from US Hughes and the production of engine access doors, pylons, and other relatively low technology through procurement of Boeing aircraft[15], both were received by PT IPTN. While these examples refer to offset in civil contracts, the benefits hypothetically 'spin on' to the defence sector due to the dual-use nature of strategic industries at that time.

The opportunity to practice offset in defence procurement surfaced in 1986 as Indonesia began to adopt leading edge technology, predominantly aircraft technology both for commercial and military purposes. This was partly prompted by trends at the regional level, as Asia's procurement accounted for about 40 percent of global firm orders for combat aircraft. Indonesia foresaw acquisition of 100 war planes over 25 years to replace its aging A4 and F-5 fighters.[16] Considering the potential value of Indonesia's arms procurement, Habibie was quick to exploit the prospective benefits by asserting that offset must be used as one of the procurement bid conditions. He argued

> "If we wanted to buy aircraft… we assess technical issues, whether they meet our conditions, use soft loans of export credit, delivery schedule… now we add one more criteria, that is the seller must provide offset… Whoever gives the biggest offset, we will buy the product."17

Habibie emphasised the change of mind-set from "preference to buy with soft loans" to "preference to buy with offset", so that the state can provide more work and skill upgrades. Beyond the domestic economic motivation, Habibie ensured that offset would enable the compatibility needed for technology transfer. Furthermore, this compatibility will spare Indonesia from thinking about marketing. Habibie elevated offset as one of the indicators of international trust in Indonesia's capability in high technology production.[18] By securing offset, access to export markets through subcontracting work would be opened. This will guarantee the sustainability of local industry, as the domestic market was hardly enough to provide the necessary economies of scale. On the other hand, sustained production capacity is expected to justify the massive investment made into the strategic industries.

5.3 Offset Development Stages

While the first offset practice might have been started in the early post-Independence era, the absence of proper archival data makes it impossible to reveal the details of this practice. Therefore, analysis of the development stages of offset must start from the start of Soeharto's administration. Across this long period, offset has manifested itself in different ways characterised by the differing strategies, regulatory frameworks, institutional arrangements, features, and its implementation across the life cycle from negotiation to the end of procurement contract. Arguably, offset has been developed from 'best endeavours' in Habibie's era to an '*ad hoc* style' in the post-reform era, to finally the 'mandatory' model, since the issuance of the Law on Defence Industry in 2012.

It was not easy to verify the exact number of offset programme in commercial and defence procurement during the three periods, as the official data do not exist.[19] A previous study by Palia[20] suggests that data on countertrade could be compiled from Countertrade Outlook and Financial Times, but this is no longer valid today. Deriving arms trade offset data from SIPRI's arms transfer database has its limits. While it helps to explain which arms procurements were accompanied by offset, the value of procurement as well as year of delivery, contains inherent weaknesses. **First**, SIPRI arms transfers serve as indicator values and not as the actual financial values. **Second**, as and when offset is listed, it lacks an explanation of the offset values and offset types associated with the procurement. To fill in the lacuna in literature, findings from questionnaires and interviews were used to provide details on such offset programmes.

5.3.1 First Offset Stage 1988-1998: Offset for Development of Strategic Industries

A study by Palia confirmed the vast use of offset in Indonesian procurement. He found that Indonesia had engaged in considerable offset activity with 25 countries and 19 organisations[21]; throughout 1987-1989 Indonesia had eight offset programmes equal to one fourth of total countertrade practice. The major offset partners at the time were West Germany, Japan, Canada, the US, Singapore and the UK. By reference to the 1982 countertrade regulation, Habibie included offset as part of the procurement conditions during this early period. This section limits the discussion of offset under President Soeharto's administration to a period between 1982 and 1998.[22]

Table 5.1 shows that there are at least eight cases of offset attached to procurement of new military equipment throughout 1982-1998 that have been confirmed with industry. The majority of offsets to the strategic industries was direct, but some were indirect or hybrid. Six out of nine offset cases, were direct or related to the purchased equipment. At least two offset cases were indirect, Rapier and Hawk, both involving British vendors. The most common form of direct offset was license production and co-production, in which the local industry acted as subcontractors to foreign suppliers. This is understandable, considering Habibie's local naming of offset as '*imbal produksi*' or counter-production with the aim of preparing the strategic industries to bid for subcontracting work of the foreign vendor.

In addition to the abovementioned offsets, there are a number of offset cases that are difficult to confirm. For example in 1982-1983 and 1996-1997 Indonesia purchased unconfirmed numbers of Bell-412 helicopters from the US which were assembled from kits in Indonesia. The second deal, worth around USD 4.2mn, could either be offset or a pure business agreement that included local content.[23] There is also an aborted offset case, in the procurement of Boeing's patrol craft jetfoil in 1983. The plan for local production of 36 ships were not continued, due to the jetfoil's inefficiency of fuel.[24]

Table 5.1 Offset in Indonesian Defence Procurement, 1980-1998

No	Procured Items	Source of Technology	Delivery	Procurement Value (in US$ mn)	Offset Value/ % from PV	Offset Category
PT IPTN/PT DI						
1	12 F-16	General Dynamics, USA	1989-1990	337	US$ 52mn	Direct
2	N/A SUT AS/ASW Torpedo	AEG Telefunken Germany	1978-1985	N/A	N/A	Direct
	SUT AS/ASW Torpedo	AEG Telefunken Germany	1988-1989	N/A	N/A	Direct
3	N/A Rapier SAM System	BAe Dynamics, UK	1985-1986	100	N/A	N/A
	Rapier SAM System	BAe Dynamics, UK	1986-1987	60	N/A	Hybrid
4	8 Hawk 100trainer/combat aircraft	BAe Systems, UK	1996-1997	(Part of) 442	Offset 35 %	N/A
	24 Hawk 200 FGA aircraft	BAe Systems, UK	1997-1998	(Part of) 442	Offset 35%	Indirect
PT PAL						
1	12 FPB 57	Friedrich Luersen Werf, Germany	1988-1995, 2000-2004	N/A	N/A	Direct
2	N/A FPB 28	Friedrich Luersen Werf, Germany	N/A	N/A	N/A	Direct
PT PINDAD						
1	N/A FNC Assault Riffle	Belgium	N/A	N/A	N/A	Direct
2	35 Scorpion 90 light tank	Alvis, UK	1995-1999	N/A	N/A	Direct

Source: SIPRI Arms Transfer Database 1980-2014; Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

Offset implementation during stage one was signified by two principal characteristics. First, there was neither a written offset policy nor a dedicated body to manage offset in Indonesia.[25] Despite offset being regulated under the 1982 countertrade policy, fieldwork research found none of the respondents being aware of this policy. Instead, offset implementation was linked to the centrality of Habibie.[26]

The sentiment is plausible, considering that at the time Habibie held strategic positions in both government through BPPT, issuing permits for high technology imports, and as the Head of three strategic industries (PT IPTN, PT PAL, PT Pindad).[27] This allowed him the authority to demand offset in procurement and channel the work to the strategic industries he preferred. The fact that Habibie was allowed to do this cannot be separated from his closeness to President Soeharto[28], who had the final say on government procurement. Furthermore, Habibie was able to generate offset due to his networking and negotiation skills, as he was a respected figure internationally and well known among the elites of aerospace companies all over the world.

Second, offset implementation had been characterised by a lack of consistency. Some offsets were requested before the procurement bid was finalised and some offsets were requested after the winner of the bid had been decided, which affected the bargaining position of industry *vis a vis* the foreign supplier in the offset negotiations. This inconsistency stemmed from the fact that Indonesia did not have dedicated human resources or a government offset body to maintain standard offset practice. Furthermore, there was difficulty in maintaining a standard practise due to the inability to predict and make sure which procurement offset could be applied.[29] Due to the absence of a written policy, it was unknown whether the implementation of offset was a blanket policy or done on a case-by-case basis, and on what threshold it was based.

In the absence of an offset body, what is exactly the role of government? Offset negotiations were handled through business-to-business channels, directly involving the strategic industries in the negotiation process. The role of government was to pave the way for this negotiation to happen, most effectively by putting the obligations for offset before the procurement negotiation commenced, or after the procurement negotiations had been concluded. An interdepartmental team in charge of government procurement control, was created in 1980 through Presidential Decision Number 10 Year 1980. The team was led by Ministry/State Secretary and supported by five state ministries/non ministerial bodies, including Bappenas and *Menristek*, reporting directly to the President. This body was tasked to research and decide the type, amount, specification, price, and procedure for government procurement. Each of government institution was allowed to conduct procurement bidding, but was not allowed to sign procurement contracts without permission granted by the interdepartmental team. It was during this short time that the interdepartmental team pushed for offset obligation.

The extent to which the interdepartmental team could determine the optimisation of offset is uncertain, because the highest authority lay in the hands of the President. The team was not the only interest group in procurement. In the case of defence procurement, the user (military and ministry of defence, which were inseparable entities at the time) would also hold its own procurement criteria. The clashing of interests between prioritising offset and prioritising military objectives was apparent in the case of the F-16 procurement. In the bidding process, the engineers had a preference for the French Mirage that offered 30 percent offset and 80 percent countertrade.[30] The offer also included subcontracting work forsome components to be produced in Indonesia, as well as French assistance on developing an indigenous fighter jet. Taking into consideration the strategic relationship between ABRI and the United States, President Soeharto chose to side with ABRI, despite the economic and technological benefits of the Mirage outweighing those of the F-16.

A survey respondent described the process in which the strategic industries were directly involved in the offset negotiation process of the F-16 and the difficulty they faced, as follows:

> "We could start negotiation once there was estimation… PT IPTN directly demanded offset… The value was based on the foreign vendor's standard practice.. before the procurement contract was signed, offset must be agreed first… Since the foreign vendor had determined the price, they could not increase it once offset was demanded."31

Another survey respondent explained that the offset negotiation process was initiated under the interdepartmental team, which then relayed the process to the strategic industries to negotiate the finer details.[32] The content of offset could be demanded by government or industry to serve specific interests, and could also be proposed by the foreign vendor following a study of local industrial capability.

In the absence of a formal offset policy, there were informal procedures that guided offset implementation. Offset policy usually regulates features like offset thresholds, the multiplier, types of offset, penalties, and so on. It was not clear whether an offset threshold; that is, the minimum offset percentage based on the total procurement cost, had been determined as a baseline for negotiation. Different results came from fieldwork research, proving that variations existed. While offset usually demanded at around 20 percent of procurement value that comes from subcontracted work[33], in other cases no threshold was applied[34]. In the case of the F-16 and Hawk procurements, it was claimed that the offset equalled 35 percent of the procurement value[35], but a fact check of the SIPRI arms transfer database confirms that offset in the F-16 procurement equalled only around 15 percent of the total procurement cost.[36] From these cases, the 'actual' threshold both turned out to be different from the expected norm, suggesting that the offset threshold depended on negotiation not policy direction.

The multiplier was used as an incentive to push investment in certain sectors, aiming at the optimisation of offset impact. By referring to the 1982 countertrade policy, along with fieldwork interviews, no multiplier was used in the offset value calculation; in other words, offset was based on a "dollar by dollar" approach.[37] A statement by Habibie, however, suggested there was a multiplier, and that instead of the buyer country, it was the foreign vendor which set the multiplier. He claimed that the offset of the F-16, led to PT IPTN receiving a multiplier, or transfer technology factor of 2.5.[38]

In the absence of an offset policy and a dedicated oversight body, there was always the centrality of Habibie and government control over public procurement and industrial production. However, the disadvantage of this centrality was the inconsistency of implementation and the lack of knowledge transfer to sustain the continuation of offset as proven in subsequent periods.

5.3.2 Second Offset Stage - 1999-2009: Offset for Strategic Industries Survival in the Aftermath of 1997 Crisis

Offset practically ceased during the economic crisis in the late 1990s, when arms procurement programmes were mostly cancelled or rescheduled as result of the lack of state funding and an arms embargo. Following the downfall of Soeharto in 1997 and pressures to reform, Habibie was forced to shelve the idea of infant industry protection and catch-up industrialisation. Habibie's influence faded, as did the role of KEMRISTEK/BPPT in both procurement and offset. The institutional arrangements set up under Habibie's era were shelved through the dismissal of BPIS in 2002, which left coordination issues between public procurement and the strategic industry' production unresolved. At the same time, the armed forces undertook reform that prioritised the removal of socio-political roles, transferred military business back to the government, and improved the conditions of soldiers. With arms procurement pushed aside in the first years of Indonesian reform, offset was no longer an issue.

Contrary to the disappearance of offset, countertrade practice continued despite the fact that its value was not as significant as in previous decades. During the years after the economic crisis, countertrade was valued at USD 150.21 million, USD 2.99 million, and USD 22.77 million in 1998, 1999 and 2001-2002, respectively.[39] In 2003, the Ministry of Trade went further by determining that countertrade was a priority programme, promoting the export of non-petroleum and mineral products as well as saving on foreign currency reserves. With the opening of alternative access to military technology from Russia in 2003, Indonesia started to procure new weapons and sought to utilise countertrade in arms procurement. Following the Indonesian Minister of Industry and Trade's visit Russia in 2002, President Megawati signed an arms procurement contract for two Su-27, two Su-30MKK and two MI-35 helicopters, worth together, some USD 193 million- in which only 12.5 percent of the payment would be made in cash[40] and the rest would be made through countertrade across an eighteen-month period.[41] The practice was lambasted by Parliament allegedly for violation of procedures, thus damaging the view of countertrade.[42]

Other forms of offset, technology transfer and local content, were included in government procurement policy through Presidential Decree No.80 Year 2003 via Procurement and Defence Ministerial Decree Numbers 01/M/I/2005 and 15/M/II/2005. While the two were often used interchangeably, which indicated a lack of clarity in their definition, no supporting regulation was issued to guide the implementation of these mechanisms. Therefore, the practical elements of offset are left to *ad hoc* negotiation. Correspondingly, in the absence of special laws that regulated arms procurement, it was left to the procurement task force whether offset should or should not be sought. As a result, while no implementation of offset is recorded on government procurements of commercial products[43], it was applied on selected arms procurement.

The first utilisation of technology transfers or local content in arms procurement was negotiated with South Korea in the purchase of seven KT-1B Wong Bee training aircraft and four landing platform docks from South Korea in 2003 and 2004, respectively. The two countries signed an arrangement concerning mutual acceptance of government quality assurances of defence materiel and services in 1999, followed by a letter of intent regarding specific defence industry cooperation in 2000. Throughout 1999 to 2003 Indonesia received a substantial amount of loans from Korea to be used in the defence sector, which included a loan for submarine overhaul valued at USD 50,988,775.[44] Bilateral relations with Korea also included utilisation of various types of offset mechanism, such as counter purchase and licensed production. Indonesia's purchase of the KT-1 Wong Bee was subsequently followed by Korea's purchase of 10 CN-235 transport aircraft manufactured by PT DI. The purchase of the LPD was tied to a licence production programme for PT PAL. No other offset programme was reported. Table 5.2. below lists all offset during the early reform period.

The issuance of Presidential Decree No.54 Year 2010 was the first formal step to bring offset back as a procurement policy tool. Article 4 (2) mentioned that in the event that domestic industry cannot meet the requirements of the user, procurement could be sourced from abroad on condition that there is domestic industry participation through technology transfer, local content, offset, joint production or joint investment. Despite the regulation, the implementation of offset was characterised by *ad hoc* flexibility. Two main factors were responsible for this condition: first, the absence of a supporting policy means there was no detailed guidance on offset implementation, which was resolved by the discretion of the procurement staff; second, the dismissal of BPIS meant there was no continuation of experience and transfer of knowledge pertaining to offset that would have been useful in the absence of guidance. Procurement staffs were disadvantaged by a shortage in guidance and experience.

Table 5.2 Offset in Arms Procurement during the Second Offset Stage (1999-2009)

No	Procured Items	Source of Technology	Delivery	Procurement Value (in US$ mn)	Offset Value/ % from PV	Offset Category
PT DI						
1	KT-1B	KAI, South Korea	2003-2012	N/A	USD2.1 mn	Direct
PT Pindad						
2	22 Tarantula IFV	Doosan, South Korea	2009-2013	70	N/A	Direct
PT Pal						
3	4 LPD	Dae Sun, South Korea	2004-2007	150	N/A	Direct

Source: SIPRI Arms Transfer Database 1980-2014; Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

It was soon demonstrated that offset implementation was far from smooth. The first noticeable problem was the lack of a planning stage preceding negotiation. The sole purpose of offset in this period was to make use of idle capacity in industry, which, unfortunately, was carried out without reference to company business development plans.[45] Furthermore, while it was clear that the offset programme derives from procurement contract negotiations, industry as the offset receiver was not included in the pre-offset implementation talks. Industry was often left in the dark until the last moment, and forced to engage with offset programmes in which they had no ownership. These problems contributed to the negative impact of offset on the procurement life cycle. For example, offset arguably contributed to the delayed delivery of domestically produced LPDs.

Offset under this period also failed in capitalising on arms procurement from Russia, Holland, and Poland. Russia - by far the largest arms supplier and provider of USD 1 bn export credits – had, however, conveyed its willingness to provide assistance to develop weaponry system and defence industry in Indonesia.[46] It was not clear whether the absence of offset from Russia was due to Russia's rejection of Indonesia's demands or because of the lack of confidence on the Indonesian side to pursue offset demands.[47] This period also recorded a number of failed offset attempts, such as the offset pertaining to the SIGMA corvette built by Damen Schelde of the Netherlands and the Skytruck aircraft from Poland. The first deal failed to secure Dutch parliamentry approval, therefore the overall production was executed in the Netherlands with minimum participation from Indonesia's shipbuilder. The second deal was where the offset credits provided by the Polish government were halted when it became known that comparable technology was produced by domestic industry.[48]

Perhaps the dominant factor responsible for the failure to capitalise on offset is the absence of proper defence management at the time. Apart from one defence White Paper issued in 2003, the government had no reference to defence-development policy. Arguably, without this knowledge, neither arms procurement nor arms production had any long-term guidance. This lack of high-level expertise was exploited by third parties to push for procurement of off-the-shelf technology from abroad. Coupled with the absence of a dedicated professional procurement organisation at KEMHAN[49], the procurement process was chaotic, tainted with a number of spur-of-the-moment actions and alleged corruption - mostly with regard to procurements from Russia.[50] Subsequent efforts to regulate procurement included streamlining the process through Defence Minister Decree/Regulation No 34 Year 2011, applying a one-door procurement policy, and obligating stakeholders to sign an'integration pact' as initial attempt to dissuade corruption from procurement.[51]

Entering the second Yudhoyono administration (2009-2014), the then Indonesian Minister of Defence Purnomo Yusgiantoro announced that the revitalisation of the strategic industries had been part of 15 programmes that President Yudhoyono had personally selected. Defence Minister Decree No 15 Year 2009 mandates the responsibility for the development of defence industry lay with KEMHAN. Its responsibility covered the formulation of the following activities: defence industry development policy; defence equipment requirements; and defence equipment production and its financing from the state budget, as well as transfer technology. Most of these tasks went to the Directorate of Defence Technology and Industry (DIT TEKINDHAN), under the Directorate of Defence Potential.[52] In 2010, the government held a national workshop on defence industry revitalisation and invited former President Habibie to deliver the keynote speech. In October, a Defence Industrial Policy Committee (KKIP) was established to formalise national policies related to defence procurement and manufacturing. Since then, offset revival was just a matter of time.

5.3.3 Third Offset Stage – 2010-2014: Making Offset Mandatory for Revitalisation of Strategic Industries

Entering the 2010s, offset has grown because a number of critical steps had been taken to ensure the participation of domestic industry in public procurement. Under the second term of President Yudhoyono's administration (2010-2014), support for the revitalisation of defence industry has solidified, culminating in the issuance of Law No.15 Year 2012 on Defence Industry (LoDI). The law stipulated mandatory offset in the procurement of defence and security equipment from abroad, which took the complexity of offset implementation to a whole new level.[53] Most importantly, any offset programme conducted after the issuance of the regulation would have legal consequences.[54]

While there was still no recording of commercial offset, there was growing number of offsets linked to arms procurement, rising from three cases during 2000-2010 to at least seven cases across 2010-2013.[55] However, none of the offset negotiations involving the procurement of submarines, corvettes, and transport aircraft met the threshold of 35 percent offset of the contract value. Offset in the corvette programme was less than the amount of the license fee required by Damen shipbuilding (5 percent of the procurement value).[56] The value of offset in the submarine procurement amounted to USD 9 million only, a miniscule number compared to the procurement value of approximately USD 1 billion.[57]

Table 5.3 Offset in Indonesian Defence Procurement, 2010-2014

No	Procured Items	Source of Technology	Delivery	Procurement Value (in USD mn)	Offset Value/ % from PV	Offset Category
PT DI						
1	9 C-295	Airbus Military, Spain	2014	256	N/A	Direct
2	12 F-16	Lockheed Martin, the US	2014	Approx. 750	N/A	Indirect
PT Pal						
3	4 Guided Missile Destroyer Escort (PKR)	Damen Schelde, the Netherlands	2017	220	Approx. 5 %	Direct
4	3 T-209 Chang Bogo Submarine	Daewoo South Korea	2017/2010	Approx. 1,000	USD 9 mn	Direct
PT Pindad						
5	37 Caesar Howitzer	Nexter, France	2014	141	N/A	Direct
6	(136) Mistral SAM	MBDA, France	2014	N/A	Approx. USD 1mn	Direct
7	(103) Leopard + (42) Marder	Rheinmetal, Germany	2013-2014	216	N/A	Indirect

Source: SIPRI Arms Transfer Database 1980-2014; Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

The third offset stage provided the most opportunities for offset. Previously in 2008, the government issued the long awaited strategic papers, comprising a regulatory framework for defence and development and a conciliatory approach to state affordability through capability-based planning. The Strategic Defence Review 2009 addressed the position regarding development, dubbing it 'Minimum Essential Forces' (MEF), and defined as the level of force able to warrant a critical strategic defence interest through fulfilment of 80-89 percent of military capability to deal with both real and potential threats. Subsequently, Defence Minister Decree No. 2 Year 2010 on MEF was released as the first amendment of the previous position, outlining the fulfilment strategy for the armed forces. The document emphasises the stabilisation of army, development and modernisation of the naval and air forces that had been neglected, and the level of force required to secure the critical strategic defence interest. This called for a transformation in defence deployment, from heavy land based forces to layered-defence with a Sea Lane of Communications (SLOCs) orientation that was more fitting for an archipelago country. In conjunction with the development of a SLOCs oriented posture, procurement planning saw major programmes emerge for both the navy and air force.

In order to garner the fruits of the arms procurement planning, a 'clearing house' was introduced to ensure that procurement and production of arms would go hand in hand. The idea is similar to the role of the BPIS in Habibie's era. No single entity held adequate authority over defence industry, let alone controlling the whole process into the defence value chain. Defence industries were placed under management of the Ministry of State-Owned Enterprise, while supporting industries were placed under the Ministry of Industry and Trade (MoIT).[58] In order to address this chaos, Presidential Decision No 42 Year 2012 concerning the creation of KKIP was issued. KKIP was established with the Minister of Defence as chief, whereas the minister of SOEs, minister of R&T, minister of industry, chief of TNI and Head of the Indonesian Police were members.[59] Within less than two years of its existence, KKIP produced a master plan for the defence industry, a grand strategy for the KKIP, a national programme, and also blueprints for research on defence and security equipment and defence and security equipment production. [60]

KKIP's role, however strategic, was not accompanied by sufficient institutional support. In order to carry on its daily activities, KKIP relied on its secretariat at DIT TEKINDHAN in KEMHAN.[61] This problem stemmed from the fact that KKIP membership "ex officio", meant that positions in other government offices were held at the same time. Membership of the Committee regarding the formulation of arms procurement policy was also vague, whether it was merely as a coordinator or decision maker. According to industry sources, the presence of the KKIP was not given significant authority with the exception of orders from the government.[62] Further effort to synchronise arms procurement planning and arms production has so far produced a 'forced marriage', which puts stakeholders in an uncomfortable situation.[63] However, LoDI has paved the way for more authority for KKIP, including requirement planning, R&D and engineering, management of industry, incentive, and cooperation.

Furthermore, Presidential Decision No. 59 Year 2013 was enacted to accommodate the expansion of KKIP's tasks. The regulation stipulated that KKIP be headed directly by the President, with the Minister of Defence acting as daily chief. Its membership spans seven ministries and two state institutions such as minister of State-owned enterprise, minister of industry, minister of research and technology, minister of education and culture, minister of communication and information, minister of national defence planning, minister of foreign affairs, chief of TNI, and chief of the Indonesian Police. A consequence of this new organisation arrangement, is that decisions made by the KKIP means decision made by executive which represent users, fund providers, and state-owned defence industries.

LoDI indirectly mandates substantial changes in the procurement procedure, which has been criticised for regulating urgent requirement and off-the-shelf (OTS) purchase only. Current arms procurement is regulated differently from other public procurement, but is not sufficiently tailored to the unique character of defence acquisition.[64] The defence sector dictates higher standards, engages heightened security considerations and secrecy, has longer life cycles and complexity that requires human resources with multi-disciplinary backgrounds, and sometimes is spared from mandatory competition. The current arms procurement regulation has too much emphasis on the secrecy issue, hence limiting procurement strategy into limited bids and direct appointments in the case of urgent requirements and minimal competition.

The current procurement procedure contains several weaknesses. The procedure does not regulate procurement of developmental items, which entails a longer life cycle and R&D spending. More attention should also be given to the pre-preparation stage in order to foresee later problems. For example, translation from operational requirements (OR) to technical specifications (TS) is often criticised as the gateway for broker intervention. Since defence technology is highly specialised, it is not easy to create competition when the TS have been hardwired to a certain provider. Hence, it is no wonder that preference for OTS, especially foreign OTS, is preferred. Lastly, offset has not been accommodated in the procurement regulation.

The current procedure also poses obstacles to national industry participation. It conditions that industrial participation should begin only after the requirement planning is hard-wired, which means industry is not involved in technology assessment (that is translating operational requirements into technical specifications) and pricing. Furthermore, procurement contracts must be concluded within the same budget year, which risks industry penalties for late delivery. The absence of multi-year budgeting means no sustainable order and funding are available for industry. While the second issue is soon to be addressed with a multi-year budgeting scheme, the first needs to be addressed with a different approach. The complexity of regulation, institutional arrangements, financing, and procurement, further convolutes the implementation of offset.

Despite the mandatory clause of offset, confusion remains as to the technicality of the implementation. First, how should the offset threshold be defined? LoDI puts a blanket mandatory offset requirement over all arms procurement from abroad with no room for negotiation, no threshold of procurement value, and no clause of absolution.[65] Second, which body should implement offset considering the clause applies to security and defence equipment procured not only by the military and police but also other ministries and state institutions as members of the KKIP. Third, who should bear the cost premium, the cost of investment for industry and other institutions as offset receivers.[66] While institutional issues have been overcome, at least temporarily, the other issues remain unaddressed and left to the *ad hoc* discretion of the stakeholders.

In order to address these institutional issues, a temporary arrangement was agreed between BARANAHAN and DIT TEKINDHAN at KEMHAN to assign the latter as offset executor. This move aims to temporarily fill up the gap in legal formal arrangements. Hosting the secretariat of KKIP, DIT TEKINDHAN has been in charge of industry output supervision, including technology development and human resources preparation. Unfortunately, DIT TEKINDHAN is not supported with suitable human resources for this task. As a result, it must hire professional consultants either from government institutions, such as BPPT or independent foreign consultants like Daewoo Logistics, to provide reports on the preparedness of domestic industry and the types of technology to absorb.[67] Among the major concerns with industry preparedness is the regeneration of human resources and the revitalisation of production facilities.

Despite the mandatory offset policy and major procurement planning in this period, offset implementation is yet to be established due to unfinished institutional arrangements, the lack of human resources, and practical regulations. BARANAHAN was determined not to violate the law, hence the reluctance to sign aprocurement contract if it does not contain an offset programme. To avoid the legal consequences of not applying offset, BARANAHAN invites participation of industry and/or DIT TEKINDHAN into the offset negotiations, which comes in the middle or at the end of procurement negotiation.[68] In some cases, as in the submarine procurement, industry is unable to optimise its bargaining position since its participation only comes after the procurement contract has been agreed. Also, in the absence of information on future procurement, DIT TEKINDHAN finds it hard to optimise industrial participation since there is not enough time for technology assessment to anticipate the offset programme.

5.4 Sectoral Case Study Analysis: Aerospace, Landsystems and Maritime

5.4.1 Sectoral Case Study: Aerospace

There have been ten offset programmes received by PT IPTN/DI from arms procurement throughout 1988-2014. PT DI received seven offsets during the first offset stage, one offset programme during second offset stage, and two offset programmes during the third offset stage. In addition to this, PT DI also received offset from commercial procurement such as the C-212 transport aircraft from Spain's Casa, Boeing 767, Airbus A330, Bell helicopter and Eurocopter, that have facilitated the company to move up the ladder of production (see chapter 4 p.189). For this research, three subcase studies have been selected: the F-16 fighter jet from the US company, General Dynamics, the KT-1 Wong Bee trainer aircraft from South Korea's KAI, and the C-295 transport aircraft from Spain's Airbus Military. The first case study is arguably the biggest offset and the first fighter jet-related programme that laid down the fundamental of composite manufacture capacity and the export of military aircraft components in PT DI. The second case is a continuation of jet fighter related work, but the lack of offset planning prevented optimisation of its benefit to the company. The third case is unique in a sense that for the first time offset was used for the specific purpose of acting as a 'restructuring' programme.

Sub-Case Study One: the F-16 Fighter Jet Programme

The first offset stage undoubtedly was the 'golden period' for PT IPTN. The company had licensed one fixed wing aircraft NC-212 from CASA in 1976 and three rotary wing aircraft, NBO-105 helicopter, Bell-412 helicopter, and Puma/Super Puma helicopters in 1976, 1982, and 1986, respectively. Licence production of the FFAR 2,75 rocket and SUT Torpedo in 1986 signified the preparedness to diversify skills and manufacturing lines to include military technology. Industrial cooperation brought in new technology and skills that enabled the company to assemble, manufacture and design new aircraft parts. Whilst in 1979, the company relied on CASA in a joint venture to develop the CN-235 aircraft, a decade later it went solo to launch the indigenously designed medium transport aircraft N250 at the Paris Le Bourget Air Show.

During this period, the government poured massive investment into the company to recruit more aeronautical engineers. Skill enhancement had taken place through foreign technical assistance, internal training centres and overseas training as well as technology transfer and know-how in the form of sophisticated equipment, such as numerical control machines and application of the most advanced techniques in computerised aerodynamics.[69] All these investments bore fruits when Indonesia finally gained international trust through export of both fixed wing and rotary wing aircraft, such as Super Puma helicopter to Malaysia in 1988, and components of commercial airframes, such as the Boeing 737 in 1987 and the Airbus A-330s in 1989.

The success of PT IPTN in becoming an eligible bidder and finally a supplier for Boeing and Airbus cannot be separated from offset. Through procurement of A-330s and Boeing 767s for Garuda Indonesia Airlines, offset was utilised to upgrade the company to qualify as an international bidder for these two giant aerospace firms. For this purpose, PT IPTN created a standalone division called a subcontract division to work on subcontract and offset programmes. A similar strategy had been applied to military procurement through the purchase of F-16s.

Offset that accompanied the purchase from US General Dynamics was not the first, but it was the biggest in terms of procurement value and offset percentage during

Stage One offset developments. In August 1986, the Indonesian Air Force decided to purchase a squadron of F-16s under the *Peace Bima Sena* programme, with plans to purchase up to 64 aircraft.[70] The procurement contract of eight single-seater F-16 block A and four dual-seater F-16 block B was valued at USD 337 million to be delivered throughout 1989-1990. Habibie demanded 35 percent offset in the form of local production of airframe parts to be used for worldwide export. The offset length was 10 years, covering the manufacture of 200 shipsets of Flaperon, Vertical Stabiliser Skins, and Doors.[71] This arrangement was crafted in such a way that it will not impact on the main procurement contract. The programme was undertaken in several stages, commencing with training and technical assistance provided by General Dynamics. The assembly was initially undertaken in the General Dynamics facility in the US, where Indonesian workers assembled detailed parts of the first 20 sets.[72] After this, assembly of the rest of the sets was conducted in a subcontractor division of PT IPTN in Bandung.

What were the principal impacts of this offset programme to PT IPTN/PT DI when measured against this study's six metrics? Arguably the offset did not contribute significantly to new job recruitment or job maintenance because at the time, PT DI was embarking on a massive recruitment campaign. It was possible that the offset programme was used to provide work for the employees to justify industrial enlargement, and not the other way around. However, as the company managed to agree sales contracts, for example, from Airbus and Boeing, in addition to indigenous programmes -such as the CN-235 and CN-250- the offset programme was viewed as a distraction.[73] This might also be due to the fact that fighter jet technology was very different to commercial aircraft manufactured in the company.[74]

In terms of skill enhancement, the offset work represented 800,000 man-hours in the manufacturing of military aircraft components - a brand new area for PT IPTN.[75] The company learned the basics of advanced structure composite manufacturing technologies[76], and as consequence gained the ability to manufacture six types of component, consisting of 3,476 units of FEAD LH, FEAD RH, Fuel Pylons, Weapon pylons, vertical fin skins, wing flaperons, and main landing gear doors.[77] The pylon work was seen as one of the toughest challenges the company had ever come across.[78] It was not clear what was the cost of learning this new technology and who bore the financial burden.

Fieldwork research yields various explanations as to the impact of this offset programme.[79] However, it needs to be stated at the outset that it is unclear whether IPTN had succeeded to meet the quality standards of General Dynamics and whether the programme was actually even concluded[80]. It is possible that the the programme was only fulfilled through provision of training from General Dynamics.[81] Another version would be that the programme was successful. Habibie claimed to have mastered manufacturing of spares for sophisticated jet fighters, particularly in composite technology, and offered the technology to Russia in his efforts to negotiate offset in the procurement of Su-30s.[82] Apparently, though, the technology is yet to be applied to the Russian fighter jet. The objective was to get PT IPTN qualified as a bidder to supply on the Sukhoi airframe. This bold offer signified Habibie's confidence in the ability of his company on fighter jet airframe manufacturing.

Apart from the vagueness of the success of PT IPTN in manufacturing fighter jet components, whatever benefits came out of the offset programme proved unsustainable. For example, jigs and tools associated with the manufacture process of F-16 components were abandoned, because no other orders followed.[83] Political issues played a role in aborting further procurement. In 1996, the government tried to negotiate a further procurement of up to 11 F-16s initially designated for Pakistan, via a low interest loan and offset of 30 percent of the price.[84] However, US concerns regarding alleged human rights abuses in Indonesia led to a tortuous Congressional process in approving this sale.[85] The following year saw Soeharto's frustration with the US end in a decision to withdraw the demand for F-16s as well as Indonesia's participation in the international military education and training program (IMET).[86] As bilateral relations of the two countries took a new low, Indonesia decided to diversify procurement of fighter jets by buying from Russia. This move arguably severed any possibility of further cooperation between PT IPTN and General Dynamics.

Sub-Case Study Two: the KT-1B Offset Programme

Offset pertaining to KT-1B Wong Bee was the first in the aftermath of the 1997 economic crisis that devastated Indonesia's strategic industries. Efforts to settle the country's debt of IDR 3.8 trillion led to the massive dismissal of 12,000 workers and a number of directors.[87] The following years saw the company battling against strikes that slashed its productivity. Again in 2004, further restructuring reduced employment from 9,670 to 3,720.[88] PT DI hit rock bottom in 2007 when the business court in South Jakarta issued a verdict of bankruptcy. Problem after problem throughout the early 2000s effectively wiped out remnants of the company's glorious past. The company had no option but to reinvent itself, renamed as PT DIRGANTARA (PT DI), and abort ambitious indigenous programmes, including the N-250 and N-2130. Regardless, the company still retained its competitiveness and managed to secure orders for aircraft components from Airbus as well as other commercial and military aircraft companies from several countries.

The only offset received by PT DI under the second offset development stage was through procurement of South Korean KT-1B Wong Bees since 2003. The aircraft is a single engine turboprop that can be used for both basic trainer and light attack missions. It has been indigenously built by Korea since 1988, to meet the requirements of the country's air force. KAI received its first order for 85 aircraft in 1999, which was delivered through 2000-2002.[89] One year later, KAI managed to sell seven aircraft to the Indonesian air force acrobatic team Jupiter.

Indonesia procured 18 KT-1B Wong Bee trainers in two batches through 2003-2008. The first procurement of seven aircraft with spares was valued at USD 60 million, followed by another order for ten aircraft in 2006.[90] Offset was given to PT DI in the form of final assembly of 9 (nine) aircraft, familiarisation or modification of 2 (two) aircraft previously assembled in Korea, and collaboration on 1 (one) aircraft. The programme brought in work valued at USD 2.1 million or less than 5 percent of procurement contract value.[91] This offset is anecdotally described as a 'taken for granted' project, meaning that PT DI was not only excluded in the negotiations but also was not in a position to decline the work.[92]

The offset programme consisted of several stages.[93] The activity endured for seven years (2005-2012), longer than agreed. The first stage was the familiarisation stage, whereby two staff of PT DI were sent to the KAI factory in South Korea, sat in a classroom, and witnessed first-hand the process of aircraft manufacture - all in less than a week. Subsequently, a team from KAI was dispatched to Bandung to conduct an audit of the company's technological capability and facilities such as the hangar and painting workshop. The audit concluded that PT DI met the standard of KAI and therefore assembly could be done without difficulty. KAI provided all the materials related to the assembly jobs including the tools to be used in Bandung.

The contribution of this programme to employment in PT DI was insignificant. Less than ten people were involved in the manufacturing process, approximately 0.3 percent of the overall employment in PT DI at the time. The programme also fell short in its contribution to skill upgrades. While PT DI learned the basics of advanced trainer final assembly, including that relating to ejection seat and canopy, such skills were not significantly value adding because the technology was perceived as inferior to the existing capability of PT DI. No technical assistance was required to oversee the work, but Korea placed a supervisor throughout the assembly process in Bandung.[94] Most of the tools required for the work were common tools, readily available in PT DI. Special tools, for example tools to fit the Hartzell four-blade aluminium propeller, were provided by KAI and immediately taken back when the programme concluded. One notable contribution of this programme was the discipline of workers in PT DI. Apparently the assembly work was undertaken in the same hangar with other programmes. The strict discipline of the Koreas strengthened the work culture work in the hangar, and permeated across the different different activities outside the Korean offset programme.

The programme also did not contribute to the creation of any supply chains, primarily because the Koreans supplied all the materials. This arguably contributed to the tortuous progress of the programme. PT DI claimed to be able to finish assembly of one aircraft in less than a month; hence assembly of nine aircraft could have been done in less than a year. The fact that the programme stretched to seven years had more to do with the delay in material provision from Korea than any local deficiences. PT DI indicate that there was no problem in manufacturing components for the aircraft, dependent on the the Koreans providing the drawings.

Another part of the offset programme was the modification of the two KT-1B aircraft previously assembled in Korea. The aircraft were grounded at the Adi Sucipto air force base, hence PT DI had to dispatch its staff to Jogjakarta. The work began with a one-day session during which PT DI staff were introduced to the tools and operational guidelines of the KT-1B. The overall modification was concluded within 20 days. All work under this programme was performed for KT-1B, and purchased by the Indonesian Air Force, and no export was recorded.

As in the case of offset in the F-16 programme, any benefits from this offset were also not sustainable. There was no contact whatsoever between PT DI and KAI on further collaboration on the KT-1B, despite the success of the Koreans in exporting around 40 aircraft worth USD 400 million to Turkey in 2007 and the 60 KT-1s to the Indian Air Force in 2010.[95] Survey respondents acknowledged that the Indonesian offset programme did not include any clause for maintenance work to be done at PT DI. Even if there was, the value would not have been significant. Indonesia did not pursue procurement of more KT-1Bs, instead chose Brazil's Embraer EMB-314 Super Tocano – an aircraft with a similar design to the KT-1B, including counter insurgency capability.

Further collaboration was made possible when Indonesia purchased 16 T-15 Golden Eagle trainer aircraft from KAI in 2011. The Koreans offered offset similar to that on the KT-1B, but this time allowing detailed drawings of the parts of the aircraft, such as the engel and certain brackets, to be manufactured domestically. PT DI turned down the offer, arguing that it was not worth the necessary investment. Senior executives of KAI stated that although KAI want to expand its footprint in Indonesia, the small sales volume meant that it was uneconomical to do so.[96] Furthermore, PT DI was beginning to be swamped by orders for aircraft both from domestic and foreign customers. PT DI and KAI have had further collaboration in the form of the KFX/IFX 4.5 fighter jet that commenced in 2011.

Sub-Case Study Three: the CN-295 Offset Programme

Entering 2010, PT DI managed to escape the worst and was back on its feet again, enjoying the full support of government. Sales were strong and the company's organisational structure reflected its business, with five divisions providing the manufacture of tooling and aircraft components for Airbus (A380/ A320/A321/A340/A350), Boeing (B-747/B-777/B-787), Eurocopter (EC225/EC725), and Airbus Military (C212-400, CN 235), assembly and the integration of CN235-220, NC212-200, NBO-105 helicopter, Bell-412 helicopter, NAS0332C1 helicopters.[97] Furthermore, the company also provided integrated logistic support and customer support, maintenance, repair, and overhaul, as well as alterations for inhouse and foreign products, spares support and commercial airline business.

As a leading technology company, PT DI had been consistent in pursuing new technology ventures whilst suffering from a lack of adequate funding. Its R&D division employed around 600 people whilst most of the R&D budget came from profit - which recorded a tenfold increase between 2007 and 2008 as well as a tripling from 2009 to 2010.[98] PT DI employed a three-pronged strategy: acquisition of foreign technology as in the case of C-295 (2012), indigenous R&D in developing the N-219 small transport aircraft with LAPAN, and joint development of the KFX/IFX fighter jet with South Korea (2012-). R&D collaborations were running with at least nine partners from various government institutions, including the armed forces, BPPT, LAPAN, and other strategic industries. Throughout 2006-2010, PT DI had six R&D programmes, three linked to the new variant of the CN235 (Maritime Patrol Aircraft version for the Indonesian Navy, antisubmarine warfare for Turkey, and Maritime Patrol Aircraft for the Korean Coast Guard), the indigenous missile Rhan 122 in cooperation with LAPAN, and the conceptual and preliminary design of the N-219; the latter two were made possible with government financial support.

Recently, however, the company has faced several challenges. By 2011, PT DI recorded employment of 4,196 people - only 67 percent of which were full time staff- with expertise on production, engineering, and management.[99] Human resources were a major problem for PT DI because 42.16 percent of workers would enter retirement within one to five years.[100] The company admitted difficulties in new recruitment - due to the lack of competitiveness in offering incentives to the top graduates - and skill upgrading. There was a plan to regenerate and manage human resources to optimise productivity and ensure continuity of expertise in aircraft design and manufacture. The company also recorded problems with infrastructure and facilities, most of which have been around for 20-30 years or more. The aging facilities rendered low efficiency, ranging from between 50 to 80 percent, compared to new facilities; as a consequence, PT DI's manufacturing capacity is limited to 12 fixed-wing aircraft per year.[101]

To address the aforementioned problem, PT DI plans a restructuring and revitalisation programme (PR) at IDR 1.1 trillion for the next five years, equal to approximately 7-8 percent of total income projection.[102] In July 2011 PT DI signed a strategic collaboration agreement with PT PPA and Airbus Military, which includes an 18 month recovery plan to upgrade the company's process, engineering, marketing and MRO capabilities, with the technology to build and market C-295 medium transport aircraft. The C-295 is a stretched version of the CN-235, initially produced in 1998, and now operated by South Korea, Vietnam, and Thailand.[103] Airbus is no stranger to PT DI as both companies have had a good relationship for more than 30 years, which included co-design and co-production of the commercially successful CN-235.[104] PT DI has been the supplier of the inboard outer fixed landing edge (IOFLE) wing assembly for the Airbus A380 since 2002.

The above agreement preconditioned the Indonesian government to procure the aircraft. In 2012, PT DI and Airbus Military agreed a government contract to replace the aging Fokker-27 – the workhorse of domestic flights that has suffered many accidents. The contract was valued at approximately USD 252 million with an offset clause valued around 30 percent.[105] Former Defence Minister Purnomo Yusgiantoro proclaimed the benefits expected from this programme:[106] additional capability, workload, and technology transfer to the defence industry; the absorption of 2,000 workers - almost half of the current employment in PT DI; the diversification of new products for the Asia Pacific market; and the generation of financial and management benefits to boost the performance and competitiveness of PT DI in the region. C-295 was renamed CN-295 to reflect the collaborative venture between PT DI and Airbus Military.

The offset work consisted of 5 (five) programmes: (1) aero structure; (2) manufacture of rear fuselage; (3) delivery centre; (4) skills enhancement; (5) service centre/MRO. Starting from mid-2012, Airbus Military dispatched experts, tooling and machinery, as well as IT systems, to improve the efficiency of production systems in PT DI.[107] The overall programme was expected to last 12 years. Programme three, the delivery centre, was prioritised due to the obligation to meet the user's demands. By mid-2014, PT DI had concluded delivery of five out of the nine aircraft. The work, included assembly, functional checking, painting, interior fitting and last flight-line check, was valued at USD 7.4 million with Airbus Military providing the ground equipment for the flight-line.[108]

The first programme, aero structure, necessitated PT DI to manufacture the emphenage of the aircraft with a total value of USD 53 million, valued at USD 500,000 per piece.[109] For this, the company also received intangible technology transfer in the form of methods of production and technical assistance worth USD 3.4 million, and approximately USD 31 million will be reimbursed in cash for the payment of work packages.[110] The second programme, rear fuselage, necessitates PT DI to manufacture components valued at USD 40 million over a 12-year period. Airbus Military would provide equipment worth USD 12.8 million for this programme. PT DI dropped the production of the skin, believed thathigh investment required for chemical millingwas uneconomical.

The CN-295 programme holds a vital role as the vehicle for restructuring PT DI. The programme is expected to contribute significantly to addition workloads and skill enhancement. Assembly of the aircraft would require 120,000 man hours per unit, with every hour valued at around USD 25.[111] Employment created by this programme is hard to measure, as the company is embarking on a massive replacement of the aging workforce at the same time. Skill enhancement is expected to materialise in the form of computer-based training for the inservice programme, valued at USD 8 million.[112] Airbus Military will provide the equipment and license worth USD 6.7 million, whereas PT DI is only required to provide the building in Bandung.[113] PT DI will be given more than USD 400,000 to provide the training for Airbus Military for four years.[114]

Technology transfer is expected to prepare PT DI to become the maintenance centre of the CN-295. It is estimated that heavy maintenance will be required five years after sales. For that purpose, Airbus Military will provide the copy of procedures and international standards to support quality management services. As for supply chain management, it will be a daunting task to create a domestic supply chain to support PT DI, due to the high quality requirements requirements of the aircraft industry. In terms of export, PT DI and Airbus Military are still negotiating on the terms of the agreement to address this sensitive commercial issue.

Table 5.4 Selected Offset Programmes in PT IPTN/DI

No	Programme	12 F-16	KT-1B	CN-295
1	Stage	Stage One	Stage Two	Stage Three
2	Type of offset	Direct	Direct	Direct and indirect
3	Scope of offset programme	Training, assembly, manufacture six types of components	Training, assembly	Training, manufacture (empennage, rear fuselage), restructuration, delivery centre, technology transfer
4	Source of Technology	General Dynamics, USA	Korean Aerospace Industry, South Korea	Airbus Military, Spain
5	Length of programme	(1989-) Approx. 5 years	(2003-) Less than a year	(2012-) 12 years
6	No of employment, job maintained	No	No	N/A
7	Skills	Yes	Yes	Yes
8	Transfer of technology	Yes	Yes	Yes
9	Supply chain creation	No	No	N/A
10	Export	Yes	No	Possibly
11	R&D	No	No	No
12	Post contract relations	No	No	N/A

Source: SIPRI Arms Transfer Database 1980-2014; Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

5.4.2 Sectoral Case Study: Land systems and Ammunition

There were seven offset programmes granted to PT Pindad through arms procurement through 1988-2014. PT Pindad received two offset programmes during the first offset stage, one offset programme during the second offset stage, and four offset programmes during the third offset stage. In addition to this, PT Pindad also received offsets from commercial procurements, such as license production of generators from Siemens Germany, which secured exports to Africa in 1996. For this research, three sub-case studies have been selected: the Scorpion light tank from the UK company, Alvis, the Tarantula IFV from South Korea's Doosan, and the French Nexter company's Caesar Howitzer. Offset in the procurement of the scorpion light tank arguably laid the foundation for capability in the armed vehicle sector. The second case involving Tarantula IFV was the only offset received by Pindad during the second stage of offset that happened to be also related to vehicle manufacturing. The last sub-case study involves French howitzer providing the first opportunity to manufacture indigenous armed vehicles as a subcontractor to a foreign vendor, paving the way for quality improvements and international marketing.

Sub-Case Study One: the Scorpion Light Tank Offset Programme

Although Pindad was originally a defence company, it was appointed as a strategic industry with a dual-use portfolio in 1983. As with other strategic industries, Pindad's technological ability had been built upon industrial cooperation that included offset and license production. PT Pindad enjoyed licences to produce the Fusil Nouveau Type Carabine (FNC) assault rifle from Fabrique Nationale de Herstal (FN) Belgium in 1983. This purchase had given Pindad the capability for modification and indigenous design of the local acclimated version of the FNC dubbed *Senapan Serbu* or SS, that later was used as the standard assault rifle for the Indonesian armed forces in 1991. Other industrial cooperation on light ammunition was conducted with Salgaduk.

Pindad's commercial leg began when the company was designated to become a supplier of machine tools in 1984.[115] License production was conducted with Germany's Siemens for generators, Taiwan's YAM and Yeong Chin for machine tools, and casting products for Thyssen RH Germany.[116] Pindad formed several joint ventures, among others with Siemens for fabricating various high precision industrial components, with Lucas Industries PLC for auto and aerospace systems manufacture[117], and with MANN for gas turbines[118]. Cooperation with Lucas was aimed to supply the needs of high precision aircraft components for IPTN, such as flap controls for aircraft wings and tails, flight and control systems and power systems.[119] Furthermore, the JV also aimed at providing components for the automotive industry to support the national car programme. By 1997, PT Pindad also acted as a key supplier to the locomotive industry, by manufacturing gear cases and brakes.[120] The company's competitiveness in international markets was proven by the export of 6,100 rail fastenings to Belgium in 1996.[121]

Perhaps of the three strategic industries, Pindad has been the less privileged when it comes to government attention and support for arms production. Indeed the policy at the time was for Pindad to spend 20 percent of its capacity for arms production and 80 percent for commercial production during peacetime.[122] In 1988, PT Pindad experienced production capacity expansion problems and cash flow difficulties due to limited capital injection and late payments by the government, while the company's requirement for capital insertion of IDR 1,3 trillion was only 50% approved, in the form of equity investment.[123] Low capital affected the company's production capacity, which could only achieve 70 million out of 120 million bullets for the armed forces requirements per year.[124] The company failed to triple its production capacity and as consequence failed to seize the opportunity of meeting demand from the domestic market and further penetrating the export market.

When Indonesia procured 35 Scorpion light tanks from Avis UK (1995-1998), it was agreed that the offset would be in the form of assembly work.[125] The procurement itself was surrounded by controversy, with the involvement of the then President's daughter as the third party and allegations of illegal mark up.[126] A survey respondent said that this offset actually did not match with the core expertise of Pindad at the time, which was manufacturing high precision technology.[127] It was the army as the user that negotiated the offset for the assembly of the light tank, albeit that the programme was located at Pindad, given the availability of suitable facilities and tools.[128] As a consequence, the company struggled to allocate sufficient workers to service the needs of the offset programme.[129]

Around 20 staff from the various divisions were mobilised to participate in the training and assembling process of the 10 (ten) light tanks. Avis provided 3 (three) staff for technical assistance for a month, directing Pindad in establishing the necessary facilities and providing special tools.[130] In order to optimise the learning process, Pindad devised a strategy to assign not just technicians, but engineers and trained workers, in the assembling process. The partnership with Avis did not last long because the company was later dissolved.

Offset from Alvis proved to have a sustainable impact, though it is difficult to pin down the extent of it in the midst of other variables that also contributed to the development of indigenous capability in manufacturing military vehicles. Development of indigenous armoured personnel carriers (APC) was facilitated by the British embargo on the use of the Scorpion light tank in the Aceh conflict in 2004. Indonesia immediately withdraw the 36 Scorpions and rushed the experimental Pindad-made light armoured personnel carriers.[131] Those involved in the Scorpion offset programme became the engineers and designers of the indigenous six-wheeler APC, which was developed in cooperation with BPPT throughout 2002-2003[132] and received certification from the army in 2006.

Pindad received its first order in 2007 directly from the hand of the then Vice President Jusuf Kalla[133]. Mass production of the indigenous APC - dubbed 'Anoa' - was started in 2008-2009 to meet the requirements of Indonesia's Garuda peacekeeping battalion in Lebanon. The vehicle successfully attracted attention from international buyers, such as Brunei and Timor Leste that had ordered 15 and 4 (four) respectively.[134] By 2011, the production line employed 187 people and had manufactured more than 150 of these vehicles in several variants such as command, logistics, ambulance, reconnaissance and amphibious.[135] Further development of the light-medium tank has been the priority for Pindad's R&D programme.

Sub-Case Study Two: the Tarantula Infantry Fighting Vehicle Offset Programme

Similar to other strategic industry companies, Pindad was not spared from the 1997 economic crisis. After posting debt of IDR 25 billion in 1997, PT PINDAD shifted its focus to the production of machine tools for commercial market in order to survive.[136] The company faced aging human resources, obsolete facilities, and a lack of working capital. Even with overcapacity in the manufacturing of munitions due to inoperability of some facilities, Pindad could only produce 70 million out of 120 million bullets required by the armed forces annually.[137] In 2007, Pindad reduced its workforce to 1,546.[138]

The much needed government support started slowly in 2001 when the government obligated domestic arms procurement to dampen the increasingly felt impact of the arms embargo. Pindad received orders from the armed forces and police for ammunition and rifles, especially for military operations in Aceh province. The continuous demand for arms enabled Pindad to gain the necessary experience and feedback from the user so critical for improving its products.

Pindad also continued with R&D activity even when the company was not in a position to dedicate financial resource to do so.[139] Because Pindad's market is mostly domestic, it chose to develop a number of variants that targete domestic needs, especially the armed forces. Among the strategies used for developing new products was reverse engineering and strategic alliances. For example, the first personnel carrier manufactured in 2004, dubbed the APR-IV 4x4, was built on the chassis from a commercial truck.[140] Pindad also joined a consortium to develop a national guided missile with LAPAN and the Navy, with government providing the R&D funds throughout 2005-2007.[141] Across 2001-2007 the company recorded three patents for ammunition, railway components, and rubber tracked vehicles.[142] The notable achievement under this period was in 2005 when the armed forces welcomed the newly launched SS2 V1 rifle with orders for 15,000 pieces to replace the rifles then currently used[143] and in 2007 when the then Indonesian Vice President directly placed an order for 150 Anoa armoured personnel carriers.

The armoured vehicle sector has been an area of concern due to the high level of dependency on foreign supply: 90 percent of armoured tanks used in Indonesia are imported.[144] Pindad's roadmap for armoured vehicles was already laid down, targeted at producing an amphibious cannon tank by 2013. In the absence of clear long-term procurement plans for armoured vehicles that guarantee future orders, Pindad had a difficult time to push the plan further. After the success with Anoa, the company's attempts to pursue development of a cannon panzer practically ceased.[145] The procurement of 22 Tarantula 6x6 Armoured Fire Support Vehicles (AFSV) from South Korea in 2009 was used to fill the gap in the indigenous development of a cannon panzer that Pindad had not been able to accomplish with its Anoa. However, this objective was hardly met when Pindad was only invited to the negotiation table after the procurement deal was signed.

In 2011 Pindad and Busan Ltd signed an agreement that specified a Korean obligation to deliver 11 units of the Tarantula to Indonesia in the form of semi knocked down kits, to be assembled in Pindad. South Korea's Doosan DST built the Tarantula using the design of the Black Box 6x6 IFV, which was claimed to be competitive against Turkish and Russian products in terms of performance and price.[146] The offset programme engaged approximately 30 people from the special vehicle division in Pindad. Engineers, operators, and management were dispatched to South Korea for 1.5 months of training. No special preparation was required, as the assembly used standard tools already available in Pindad. The assembly process was concluded in less than three months under the supervision of South Korean staff. Because the Koreans sent the material in semi-knocked down form, Pindad encountered no major issues in finishing the assembly. As a consequence, though, there is also no significant value adding, whatsoever. From this programme, Pindad claimed to only learn about Korea's work ethos and English language skills.[147] No further relationships were reported between the two companies.

Sub-Case Study Three: the Caesar Howitzer and Mistral Offset Programme

By 2010, PT Pindad has successfully developed and diversified military products and services that included assault rifles, small calibre munitions, hand grenades, bombs, tactical vehicles and fighting vehicles 4x4 and 6x6x, hence the company enjoyed strong growth in profit and sales to both domestic and foreign customers.[148] The company also came out with innovations in the form of new variants of assault rifles, armoured personnel carriers, tactical vehicles, munitions, and mortars.[149]

Despite Pindad being in a much better position, old problems still lingered in the company. Aging human resources - most of the company's workforce of 2,326 in 2011 were more than 40 years old and most were not highly educated – also there were obsolete facilities - most aged between 18-26 years old - posed fundamental problems in addition to the lack of working capital.[150] Gradual revitalisation occurred, starting in 2010 Pindad allocated IDR 150 billion to procure new machinery from Germany and France. The company also had a high dependency on foreign supply chains. In munitions production, for instance, 80 percent of raw material was imported from Belgium, India and Taiwan.[151]

Among the new products developed was a tactical vehicle of 0.75 tonnes 4x4, which was Pindad's answer to a challenge thrown by the then President Yudhoyono in 2011.[152] Around 28 staff were involved in the design and production process of a prototype named "Komodo"- a dragon-like lizard only found in one Indonesian island - was introduced at the Indonesian defence expo 2012. So far, the police mobile brigade, Special Forces, and the amphibious surveillance battalion have used small numbers of the Komodo.

Offsets pertaining to the procurement of the Caesar Howitzer and Mistral Anti Air Defence are unique in the sense that both programmes have been used to support the improvement of the indigenously made Komodo. In 2013, the Indonesian army procured 37 Caesar Howitzer 155 cannon and its ammunition from the French company Nexter for USD 108 million. The purpose was to equip Army Land Artillery with two battalions of 155mm calibre cannon with a 39 km range. Delivery has been divided into three stages: the first four units were sent in July 2013, 15 units in March 2014, and the rest in September 2015. The Indonesian MoD set a precondition for procurement of the howitzer, which was that the Nexter had to utilise domestic made Komodos as the platform.

Offset involving Nexter and Pindad has been quite exceptional compared to other offset programmes. First, Nexter had approached Pindad for collaboration even before the procurement contract was decided. Apparently, Nexter had familiarised itself with Indonesia's recent offset policy in 2012 and decided to take the first step in identifying a potential partner. This is quite the contrary of what other foreign suppliers had done, which is bordering on ignoring the offset obligation.[153] Secondly, Nexter, formerly known as Giat, had previous cooperation agreementswith Pindad in the development of the Anoa APS. Giat was the manufacturer of the VAB Panzer Indonesia procured for supporting the Garuda Contingent in the Lebanon PKO Mission in 2007. When the government subsequently decided to procure an indigenous panzer, Giat supplied the engine to power Anoa. The cooperation ended when two companies competed in the procurement bid for Malaysia. Nexter later overcame this estrangement from Pindad in order to win the procurement contract for Caesar Howitzer from the government of Indonesia.

The offset agreement in Caesar Howitzer was therefore a result of business-to-business negotiations. In this case, Pindad was positioned as a subcontractor to Nexter, supplying the supporting platform. Design of this platform was based on the Komodo and adjusted to the specific requirements of Indonesian army. Initial drawings and technical assistance were provided by Nexter, which helped Pindad to create its own design to accommodate the army. Nexter also provided technology related to integration of launching command and weather reports, hardware and software, as well as the tools unavailable in Pindad. These tools include electrostatic meters for testing. Nexter also provided guidance for integrating the sensor technology. The overall process was concluded in less than a year.

Offset pertaining to the Mistral has been been conducted in the same manner as that for the Caesar Howitzer. MBDA had been aware of the offset mandatory requirement, and hence approached Pindad to be the potential partner to provide 'local content'. The two companies agreed to involve Pindad in the procurement programme through the manufacture of 56 Komodos and integration work. While no training was given, Nexter provided the tools for designing as well as technical assistance for the integration work. The programme began with joint design and the formulation of a matrix of compliance, which contained specifications adjusted to the criteria of the user. After that, the Technical Data Package (TDP) was given to Nexter for verification of design to comply with the contract. The TDP includes a management plan that specifies the quality standard with respect to how the product must be manufactured (production process) and risk analysis. The production process was planned for three years (2014-2017). One major sore point in the programme was the value of offset. The fact that MBDA values 56 Komodo equal to four of its own Sherpas APV speaks volumes on the value it put on local capability.

In terms of employment, the offset programme pertaining to the Komodo might not be significant. The overall programme involved 60 people from two different production lines at the Pindad workshop in Bandung. In terms of skill enhancement and technology transfer, the contribution of these programmes is more prominent. Pindad acknowledged that its French counterpart had been tough during offset negotiations and insisted on high quality production, but because of this rigour, the company had learnt a number of lessons. First, the company was able to manufacture armoured vehicles at better quality - even surpassing thatdemanded by the Indonesian MoD. The fact that MBDA had acted as the first customer to Pindad means the company had to pass international standards From this, Pindad learnt the testing methods that are standard practice in the European Union.[154] The overall programme was delayed for three months due to the verification process required by MBDA, such as design verification and testing that were held in France. Second, there was a significant amount of technology transfer. For example, Pindad learned the proper method of risk analysis and the integration of various sub-systems from MBDA.

The offset programme also contributed to the development of Komodo because it began as a prototype and along the way was developed into a number of operational variants. In terms of the supply chain, Komodo production still depended on foreign technology. The vehicle has not passed the local content certification, which means domestic contribution to the production is below 40 percent of the overall value chain. Local supply chains are ready to support its monocoque body and interior, such as bulletproof glass and brackets, but high value components and sub systems, such as the engine and transmission are still imported. Since both Nexter and MBDA offset programmes are still a work in progress, it is difficult to judge the sustainability of the programme. Nevertheless, there has been talk between Pindad and Nexter on potential exports to Vietnam. Unfortunately the same thing has not occurred yet with MBDA, possibly because Komodo failed to pass the test run by the French Ministry of Defence in France.[155]

Table 5.5 Selected Offset Programmes in PT Pindad

No	Programme	Scorpion Light Tank	Tarantula IFV	Caesar Howitzer
1	Stage	Stage One	Stage Two	Stage Three
2	Type of offset	Direct	Direct	Direct
3	Scope of offset programme	Training, assembly	Training, assembly	Integration, maintenance, joint production of ammunition
4	Source of Technology	Alvis, UK	Doosan, South Korea	Nexter, France and MBDA, France
5	Length of programme	N/A	Less than a year (2003-2004)	One year (2013-2015) and three year (2014-2017)
6	No of employment, job maintained	Yes	No	No
7	Skills	Yes	Yes	Yes
8	Transfer of technology	Yes	Yes	Yes.
9	Supply chain creation	Yes	No	Yes
10	Export	No	No	Possibly
11	R&D	No	No	No
12	Post contract relations	No	No	N/A

Source: SIPRI Arms Transfer Database 1980-2014; Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

5.4.3 Sectoral Case Study: Maritime

There were five offset programmes undertaken by PT Pal linked to arms procurement across 1988-2014. PT Pal managed two offset programmes during the first offset Stage, one during the second offset stage, and two during the third offset stage. In addition, PT Pal also received offset from commercial procurements.

For this research, three sub-case studies have been selected: the Fast Patrol Boat 57 from Germany's Friedrich Lurssen Werf-Bremen, the Landing Platform Dock from South Korea's Dae Sun, and The Netherlands' Damen Guided Missile Destroyer Escort. Offset pertaining to the FPB 57 was the first to be associated with PT Pal in the production of warships. This programme had created the foundations of warship manufacturing capability in the company. Offset pertaining to the LPD was the only offset received during the second offset stage. However, offset in the PKR programme was not the only one in the third offset stage, as there was also the submarine programme that has been agreed but not yet begun. This offset is important because it aims to set a new standard in warship production in the company, especially in the manufacture of corvettes that will become the backbone of Indonesia's navy.

Sub-Case Study One: The Fast Patrol Boat (FPB) 57 Offset Programme

Under the first offset stage, PT Pal had been lavished with license production and cooperation both in commercial and war ship production. The company started with a maintenance business, then moved to shipbuilding and general engineering. The foundations of commercial shipbuilding were laid through license-production of 3000-5000 DWT cargo ships and passenger ships, such as *Caraka Jaya, Palwo Buwono,* and *Pax 500*. For warship production, PT PAL received at least two offset projects - all in the form of license production - from the procurement contract relating to the Fast Patrol Boat 28m and 57m.

In the procurement of FPB-57 (1988-1995), PT PAL was appointed as the main contractor to license produce the craft from Friedrich Lurssen Werf-Bremen (FLW) of Germany. PT PAL was obliged to pay a license fee equal to 2.5 percent from the value of work – not the value of the procurement contract - to build 12 ships.[156] Being the main contractor meant holding considerable amounts of authority to determine issues associated with procurement and the choice and role of subcontractors. This is the preferred position of a company when receiving offset.[157]

More than 100 staff from design, production, and management was sent for training in Germany in several batches.[158] The training was conducted in parallel with the production activity. FLW provided technical assistance that gradually reduced from 20 to four people throughout the offset programme, which lasted more than two years. Technology transfer was undertaken meticulously in three steps: PT PAL assembled the first ship, co-produced the second, and built the third and subsequent ships completely in its own yard. Ship production, however, was another matter; it stretched into an extended period of years: eight units were delivered throughout 1988-1995 and four units were delivered throughout 2000-2004.[159] This long period was caused by stopgap government orders and the 1997 crisis.

This offset programmes has been hailed as a success story in laying down the basic capability for warship production in PT Pal. Through this offset PT PAL gained the essential capability to produce 12 57-meter long fast patrol boats for the Indonesian Navy, one of which was successfully modified to deploy Chinese missiles.[160] This capability was then used to design a 60-meter long indigenous patrol boat, produced for the Indonesian Navy in 2014.[161] No continuation was reported in the partnership with Friedrich Lurssen Werf afterwards, one reason being the Indonesian Navy's resentment towards Germany for its part in the military embargo.[162]

Sub-Case Study Two: The Landing Platform Dock Offset Programme

The second offset stage is best described as the most turbulent time for Pal, as it went from a healthy company in 1998 to one of the unhealthiest state-owned companies in 2010.[163] Production in the shipbuilding industry was hampered by budget reductions after the 1997 financial crisis. No orders from the government meant closing down warship production and relying on commercial shipbuilding, general engineering, and MRO to survive. While the world experienced declining charter rates following the 1997 economic crisis, PAL's competitiveness in the international market surprisingly rose, evidenced by the rise of export sales from 30 percent in 1998 to 43 percent income in 2010.[164] The company was fully booked with commercial work until 2009. However, a negative cash flow continued throughout 2005-2010[165] making it difficult to access working capital and to maintain top-notch human resources and facilities.[166] The company's negative cash flow - due to customer late payments, predominantly the Ministry of Defence[167] - rendered the company 'unbankable', a status that effectively prevented it from working on new orders. Against this gloomy background, offset pertaining to the procurement of four Landing Platform Docks from South Korea's DSME Daewoo looked a blessing for PAL in bringing its warship division alive again.

Landing Platform Docks (LPD) have emerged as key military items for Southeast Asian navies, providing capability to transport troops and goods for both combat and non-combat missions. The LPD also has the capability to carry and operate landing craft and helicopters. Indonesia ordered *Makassar* Class LPDs that were designed and manufactured by Daesun Shipbuilding and Engineering Co of South Korea. DSME Daewoo International, a trading company assisted the Indonesian government in purchasing naval equipment from South Korea, and also handled the marketing. All communication exchanges took place between PAL and Daewoo, not directly with the Korean shipyard. This arrangement proved to be challenging to the implementation of the offset programme.

Indonesia placed a USD 150 million order with DSME Daewoo in December 2004 for four warships, one command ship and three common LPDS, financed by export credits. The chief of the Indonesian navy at the time endorsed the production to be shared with domestic shipbuilding, with the aim of establishing indigenous capability.[168] The first two warships, *Makassar*-class LPDs based on the design of the earlier *Tanjung Dalpele*-class, were built in Busan, South Korea by Dae Sun. The two LPDs, '*KRI Makassar*' and '*KRI Surabaya*', were delivered in 2008. The last two ships were built in the PAL shipyard in Surabaya throughout 2008-2011. The third ship was reportedly worth USD 19.9 million, while the fourth cost around USD 30 million.[169] There were approximately 800 people who participated in the design and production of these LPDs in the Pal dockyard, and most of them were contractors.[170]

From the beginning, this programme faced a number of fundamental challenges. The *first* problem proved a major barrier: language. DSME did not provide any training, supplying only blueprints and manuals in the Korean language, which no one in PAL could comprehend. The *second* problem was the modification of the ship's design. PT PAL had to come up with its own production drawings because the navy specifically requested for a stealthy design. One of the LPDs was modified to act as the flag ship with command and control systems, but this required PAL to take a different course from the original design of the LPD; it was basically a commercial ship design. The *third* problem was the readiness of the shipbuilding facility. In the warship division where the project was conducted, there was no crane suitable for lifting the heavy load of the LPDs. As a consequence, Pal was forced to divide the production of the ship into smaller pieces before integration, approximately 113-114 blocks in total.[171] Even though Daewoo had hired a third party consultant, MASTEK, to supervise the vessels constructed in Pal in 2008, numerous delays in delivery were inevitable.[172]

Despite the aforementioned issues, PT PAL succeeded in supplying the LPDs that met the requirements of the user. Noticeable improvements included new features, such as greater payload, the ability to carry five helicopters instead of three, a stealth based design that displayed a smaller radar cross section,[173] and more speed compared to the LPD's predecessor. The fourth LPD *KRI Banda Aceh* was fitted with a Combat Information Centre (CIC) and a fire control system that enabled the ship to conduct self-defence through communications with the combatant ship to protect the landing of troops and tactical vehicles as well as controlling helicopter landings.[174]

While the programme absorbed significant numbers of workers, it did not significantly contribute to employment in PT Pal as a whole, because most of the workers were hired from domestic contractors. However, it is likely that skill upgrading occurred in the local subcontractors.[175] In terms of skill enhancement and technology transfer, the programme brought significant learning in welding methods, as the process was different from that on commercial ships. As an example, welding on warships involves thin plate that is more prone to deformation than that of a commercial ship, which typically uses thick plates. Furthermore, Pal learnt the about the integration of various systems that support the capability of an LPD to half-submerge when launching a landing craft, vehicle and personnel (LCVP) from a small well-deck for landing the troops onto the shore.[176] Know-how was also transferred in the fitting of combined diesel and diesel (CODAD) propulsion systems, integrating two MAN B&W 8L28/32A diesel engines, where each engine was a 1,960kW drive twin shaft propulsion unit.[177] The set up of engines are said to be different and more challenging than the usual practice in commercial ship production, hence adding new skills to the company.[178]

In terms of adding to the local value chain, the programme only contributed to the production of low value items, such as beds and doors, whereas Daewoo supplied high value components, such as power packs, electronic systems, and hydraulic systems. The high-note of the programme was its contribution to additional capability in designing and exporting the first stealthy warship.[179] The export came from PT Pal receiving its first international order of two LPDs worth USD 90 million from the Philippines after successfully defeating South Korea and others in the procurement tender.[180] The ship, named Strategic Sealift Vessel (SSV), is an advanced version of an LPD that can carry more crew, and is equipped with a mobile hospital as well as a parking lane for tanks, trucks, and helicopters. However, around 40 percent of the components of the ships still had to be imported.[181]

Sub-Case Study Three: The Guided Missile Destroyer Escort (*Perusak Kawal Rudal,* PKR) Offset Programme

Entering the third offset development period, PT Pal was in poor condition. An assessment carried out by the ministry of state-owned industries in 2010 found that PT Pal was the least healthy of all the strategic industries.[182] The company claimed that high taxation on raw material imports and product sales, as well as no export credit facility had eroded its competitiveness.[183] Registering debt of IDR 1 trillion, the company tried to shift its focus to maintenance business and general engineering following reductions in the world charter rates, achieving only limited success. The government finally committed to a revitalisation of the biggest shipbuilding company in Indonesia in 2012, through insertion of government capital worth IDR 2.195 trillion - the biggest commitment given to a strategic industry revitalisation programme at that time.[184]

The restructuring aimed to recover the position of the company, restoring it back to its initial designed capacity; this necessitated revitalisation of human resources, the production facilities and information technology. The company needed to regenerate its workforce – many of which were above 40 years old - and upgrade skills –

especially in the engineering division. Facilities and hardware/software were obsolete, with only 80 percent of docking facilities operational and 90 percent of the computers more than 8 years old.[185] In 2012, the company laid off 800 workers as a precondition for restructuring the debt under PT PPA.[186]

Research and development in PT Pal was coordinated under the Division of Technology. Insignificant R&D spending per annum and no support from government forced the company to carry out R&D only when a new order was undertaken. Other R&D efforts were conducted though collaboration – such as with the R&D institutions of the MoD on the FPB 40m and BPPT on mini-submarine 22m- and universities, such as with ITS to utilise its hydro-lab and the test modelling of the Missile Fast Boat.[187] The company managed to gain a number of patents, i.e. design of the national corvette and design of welding tools. New products were also introduced, such as a Bulk Carrier 50,000 DWT and a chemical tanker of 24,000 DWT. The company claimed to be hesitant in investing further on R&D, in the absence of long-term technology guidance and assurances.

PT PAL's product and service portfolio has been quite remarkable compared to the time of its initial establishment. In 2010, around 43 percent of its orders came from abroad[188], including Japan and Germany, while at the same time the company controlled around 60 percent of the domestic shipbuilding market. The company could not accept all orders due to restricted capital and infrastructure.[189] Following the naval modernisation plan under the MEF that commenced in 2010, the Minister of State-owned enterprises ordered the company to focus on warship production[190]. The government placed contracts worth IDR 600 billion, equal to 33 percent of the company's income target[191] to manufacture Fast Patrol Boat 60m, a tugboat, and a landing craft unit.

The National Corvette is presently among the priority programmes for indigenisation. In the old days corvettes were part of a protection force for a convoy; nowadays, though, it addresses the wider needs of asymmetrical threats, such as terrorists, piracy, and transnational crime, as well as protection of the Exclusive Economic Zone and coastal areas.[192] The production of the guided missile destroyer escort (designated locally as *Perusak Kawal Rudal*, PKR) is aimed to indigenously supply the navy requirement for up to 16-20 ships. For this purpose, the Indonesian MoD secured a contract with Damen Schelde of the Netherlands and PT Pal to license produce four Sigma 10514 corvettes worth USD 220 million, measuring 105.1m long, with a displacement of 2400 tonnes.[193] It was agreed that the first two ships would be built at the Damen shipyard, while production of the last two would be shared between the Damen and Pal shipyards.

The offset model used in this programme is believed to have put PAL at a disadvantage. PAL was positioned as the subcontractor to Damen, not the lead integrator as in the case of FPB 57. As a consequence, PAL had practically no bargaining position against Damen. The latter demanded royalty and license fees equal to 5 percent of the total procurement value, but the value of work that went to PAL was far less than that.[194] The transfer of technology is not as expected because PAL only received low value work, such as 'stitching' the ends of a block.

Approximately 75 people are involved in the technology transfer programme and received training in the Netherlands. PT PAL specifically looked for new design capability to be used for development of indigenous products. The PKR design is based on the SIGMA class frigate Indonesia procured in 2007. Overall production absorbs approximately 300 people, both organic staff and subcontractors, working under supervision of Damen until the conclusion of the second ship's production. Damen sent eight supervisors to PT PAL's dockyard in Surabaya for this task. The production of the two PKR is scheduled to be 40 months, concluding in October 2017.

In addition to material, Damen also provides advanced methods of production and jigs and tools required for the new method. The join-ring section requires a 3D precision measurement device that PAL does not possess, and is therefore provided by Damen. The latter also provides a flat panel floor which helps to ensure the distribution of heat during welding, so as to minimise the risk of deformity. This method is new to PAL and is claimed to have spin-off potential through its application in the production of thin plate ships such as fast boats and warships.[195] Because the programme is still a work-in-progress, it is impossible to tell whether it will have a sustainable impact. PAL expects that through this cooperation Damen will be familiar with PAL and thus more willing to place another order in the future.

While the possibility for export to third countries exists, since Damen has already secured exports of the SIGMA corvette to Morocco, and negotiated with the Vietnamese for the sale of four ships, it is difficult to see how PT Pal will be included in future exports of SIGMA class vessels, as Damen has also offered offset to prospective buyers like Vietnam to jointly develop the ships.

Table 5.6 Selected Offset Programme in PT PAL

No	Programme	Fast Patrol Boat (FPB) 57	Landing Platform Dock (LPD)	Guided Missile Destroyer Escort (PKR)
1	Stage	Stage One	Stage Two	Stage Three
2	Type of offset	Direct	Direct	Direct
3	Scope of offset programme	Training, assembly, license to produce	License to produce	Training, assembly, license to produce
4	Source of Technology	Friedrich Lurssen Werf-Bremen, Germany	DSME/Dae Sun, South Korea	Damen, The Netherlands
5	Length of programme	(1988-) License production up to 12 ships	(2008-2011) Three years	(2013-) 18 months per ship/ 40 months overall
6	No of employment, job maintained	No	No	Yes
7	Skills	Yes	Yes	Yes
8	Transfer of technology	Yes	Yes	Yes
9	Supply chain creation	No	No	N/A
10	Export	No	Yes	N/A
11	R&D	No	No	No
12	Post contract relations	No	No	N/A

Source: SIPRI Arms Transfer Database 1980-2014; Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

5.5 Evaluation of Offset Performance

5.5.1 Employment

Offset's contribution to employment and job retention are measured by the number of jobs created, the type of jobs according to the level of skills and education, and the numbers of high quality jobs maintained (chapter 3, p.151). In their golden period, the strategic industries employed thousands of workers of top-notch quality due to the partnerships with top state universities and the scholarship programme provided through BPPT. In the first offset stage, the total employment in the strategic industries reached 40,000 people.[196] In 1993, PT Pal employed 6,000 workers spread over five divisions: maintenance and repair, general engineering, electronics and weapon, R&D, and merchant ships. The same year, PT Pindad employed 5,600 workers, some six percent of which were engineers and technicians. PT IPTN started in 1976 with around 500 workers and by the late 1990s it employed 16,000 workers. The prestige associated with the strategic industries at the time meant they had no issues in attracting the best graduates to work in the company.

While the challenge in the early offset development period was to recruit educated and skilled workers, retaining them in the company became the challenge in the subsequent periods. Following restructuring in early 2010s, the three strategic industries lost significant numbers of skilled workers as well as the expertise long honed. Each of the companies faced a daunting task of massive regeneration and preservation of the accumulated expertise. The company that suffered the most was PT DI, where many of its workers had retired or were about to retire in the early 2010s.

As the strategic industries contracted rapidly across the three offset stages, it is valuable to evaluate the impact of offset on job creation and job retention.[197] While employment is viewed as one of the principal strategic objectives of offset (p. 230), none of the survey respondents could pinpoint its positive impact on employment. Table 5.7 below shows the overall impact of offset on employment in PT DI, PT Pindad, and PT Pal throughout three offset stages. While job retention is noticeable in the third offset stage, no significant employment recorded as a direct impact of offset.

Table 5.7 Offset Impact on Employment in PT DI, PT Pindad, and PT Pal

Offset	PT DI	PT Pindad	PT Pal
1st stage	No	Yes	Yes
2nd stage	No	No	No
3rd stage	Yes, job creation and retention	Yes, job retention	Yes, job creation and retention

Source: Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

In the first offset stage, offset was used to provide high value work to justify massive recruitment. This way offset acted more to prevent a 'brain drain' of the educated and trained workers created to supply the strategic industries. Although offset created new employment in military production at PT Pal and Pindad, the impact was not sustainable. The warship division at PAL was starved of orders following the 1997 crisis, and production was thus abandoned until the second offset stage. The employment impact from the Scorpion light tank offset programme at Pindad was not felt until the development of indigenous armoured vehicle began in early the 2000s, which helped to create a new production line in the company.

The second offset stage also shows no significant impact on employment in the three industries. Arguably, offset work provided necessary work to retain employees during the stopgap of government orders. In reality, offset work had not been significant to PT DI and PT Pindad because only small numbers of employees were engaged in the offset programmes; for example, ten people in PT DI and 30 people from Pindad. While the biggest employment impact was provided by offset on the LPD programme in PT Pal, it actually created more opportunities for subcontractors than for organic workers (p.243).

The third offset stage shows better results for job creation and job retention due to the specific use of offset. For example, offset in PT DI from the CN-295 was used to support restructuring that included regeneration of workers, albeit that the exact numbers have not been verified. Offset in PT Pindad served partly to retain jobs, because it used available workers from existing production lines, whereas in PT Pal offset work was used to provide learning for current employees as part of a regeneration and transfer of knowledge programme.

Job creation and job retention have become significant issues for defence industry nowadays, hence should be given more attention and linked to the strategic objectives of offset programmes in the future. While recruitment of competent people does not constitute a problem for Pal[198], it does for PT DI and PT Pindad. PT DI had difficulty in attracting fresh graduates due to its unattractive remuneration system when compared to the private sector.[199] PT Pindad also faced similar issues; demand for expertise in highly specialised sectors, such as ballistic, explosives and metallurgy has not proved attractive to suitably qualified graduates.[200]

5.5.2 Skill Enhancement

Offset's contribution to skill enhancement is measured by the addition of new skills, improvements in existing skills (such as certification), training (local and abroad), as well as technical assistance (chapter 3 p.151). The strategic industries have been recognised for playing an additional role in enhancing the skills of prospective human resources. According to Hill, the strategic industries - most importantly PT IPTN - have introduced a wide range of new skills into Indonesia through training abroad, expatriate assistance, as well as internal training.[201] For example, less than a decade after PT IPTN's establishment, the company claimed to have graduated over 5,500 staff from its internal training programme.[202] The same is also claimed by PT PAL, which has provided training and courses with a maximum capacity of 1,000 students in shipbuilding, welding, boat building, electrical and mechanical engineering, and carpentry.[203] Offset's contribution of offset to skill enhancement in the three companies has been varied, as shown in table 5.8.

In the first offset stage, offset was used to lay down the basic skills through training as well as technical assistance for assembly, manufacturing, and integration work. PT DI acquired significant capability in manufacturing new material for the fighter jet. While such skills were used as leverage to negotiate offset in the purchase of other fighter jets[204], these skills eventually went to waste in the absence of new orders.[205] PT Pal received skill enhancement in the design and welding of warships that required special certification. Skills pertaining to the integration of electronics and weapon systems enabled the three firms to be lead integrators in domestic defence production. However, low procurement scales and stop-gap government orders hampered efforts to sustain and hone new skills generated from offset.[206] Skills then faded when people moved to non-defence divisions - where spin-off was not encouraged - or leaving the company. [207]

Table 5.8 Offset Impact to Skills Enhancement in PT DI, PT Pindad, and PT Pal

Offset	PT DI	PT Pindad	PT Pal
1st stage	Yes. Training, technical assistance, manufacturing	Yes. Training, technical assistance, assembly, design	Yes. Training, technical assistance, assembly, design, production
2nd stage	Yes. Training, assembly	Yes. Training, assembly	Yes. Technical assistance, design, assembly, integration of weapon systems
3rd stage	Yes. Training, technical assistance, assembly, manufacture	Yes. Manufacture, integration of electronics and weapon systems	Yes. Technical assistance, training, design, manufacture, assembly, integration of weapon systems

Source: Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

The second offset stage showed no significant skill enhancement for the defence industries (except for PT Pal), most probably caused by lack of planning and industrial participation in early offset negotiation. As a consequence, offset was isolated from the companies' skill upgrading requirements. Instead, most offset work in this stage was mostly assembly work of minor technologies when compared to that of existing domestic industry. This is signified by the absence of extensive training and technical assistance in both the KT-1 Wong Bee and Tarantula programmes. Furthermore, the minimum procurement scales of production - only 12 airplanes and 11 vehicles - and no maintenance contracts renders it is uneconomical for further investment in related skills. Only PT Pal received significant skill enhancement through the LPD programme, as signified by the technical assistance supplied over three years, enabling the design of a new ship, manufacturing, and integrating complex electronic systems.

The third offset stage has generated more skill enhancement apart from assembly and integration. New skills, such as risk assessment and testing, have been useful for PT Pindad to improve the quality of its land systems to meet European defence standards.[208] While no training was received, the support of foreign technicians at Pindad proved to be as helpful.[209] While PT DI did not receive significant skill enhancement, it incorporated offset under the restructuring programmes for more targeted objectives. PT Pal is the one defence company potentially receiving the biggest skill enhancement package through the PKR project, gaining from both overseas training and technical assistance. Overseas training was conducted for managerial and high skilled workers related to electronics, weapons and combat systems, as well as for operators. Still, the company claims to have a brain drain in the engineering division, due to challenges in recruiting and maintaining people with design skills - which are considered as critical in shipbuilding.[210] Challenges remain on how to use offset to gain special skills required for the industry and to maintain the skills generated from offset.

5.5.3 Transfer of Technology

Technology transfer is measured by, first, the quality of technology transferred, whether it is superior, equal, or inferior when compared to that already existing in the three companies (chapter 3 pp.151-152). Second, the type of technology that can be transferred ranges from methods, knowledge (know-how and know-why), process, hardware, software, to ‘human ware’, like industrial discipline and language. Third, licenses must also be considered because they signify the depth of technology released by the vendor that affects the sustainability of offset benefits in the receiving firm, most importantly the license to export (chapter 2, p.74). Table 5.9 summarises the impact of offset on technology transfer in three firms.

Entering the second offset stage, technology transfer was not significant - perhaps with the exception of PT Pal. Most of the manufacturing capability at the time had become obsolete in the absence of investment into new facilities. Through offset work PT DI and PT Pindad acquired know-how technology in the form of assembly and modification, though considered as low skill work. PT Pal received technology transfer in the LPD project in the form of blueprints, jigs and tools, but the license to export was not given by the vendor.[211] In addition, skill enhancement was also enjoyed by the subcontractors, i.e. learning how to read blueprints and methods for warship production. Interestingly, all three companies considered a lasting technology transfer to have resulted in the form of transfer of 'human ware' such as language ability and discipline[212], signifying a deficiency of such values in the the existing workforce.

Table 5.9 Offset Impact on Technology Transfer in PT DI, PT Pindad, and PT Pal

Offset	PT DI	PT Pindad	PT Pal
1st stage	Yes, process technology, hardware	Yes, know how	Yes, design, management, production, know-how, license
2nd stage	Yes, know how, discipline	Yes, know how, discipline, language	Yes, design, know how, licence
3rd stage	Yes, management, production, know how, hardware, software, license	Yes, management, testing, hardware, software	Yes, design, management, know how, production method, know why, license, discipline

Source: Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

The third offset stage generated more technology transfer to the three firms. PT DI received hardware and software, licenses, as well as know how in the manufacturing of the rear fuselage of the N295. PT Pal received transfer of technology in design, production, management as well as in process for manufacturing six modules of the PKR. Whereas PT Pindad received transfer of knowledge on integrating hardware and software in the weather reading and command system, risk assessment methods, and in the new testing hardware and methods to improve production. All three companies acknowledged that barriers in technology transfer exist, in the form of access to licenses and transfer being limited to know-how only. Furthermore, jigs and tools as well as hardware/software provided by vendor have mostly been abandoned after the offset concluded. Not only the absence of follow-on orders caused this, but also the inability of the firm to apply this technology to other production, or spin off.[213]

5.5.4 Value Chain Creation

Offset's contribution to supply chain creation occurred, as signified by forward and backward linkages (chapter 3, pp. 151-152). Ideally this should be measured in the form of input and output analysis of defence production. However, the quantitative data are difficult to access, and thus local content[214] - referring to 1) the percentage of domestic contribution in the value chain, 2) the existence of supply chain due to import-substitution of components and the participation of local subcontractors - are used instead.

It has been observed by Hill that there is a phenomenon of near-one hundred percent 'in-house operation'[215] that has been common across SOEs. As a consequence, backward linkages - most particularly to smaller component manufacturers through subcontracting agreements - is limited. In 1995, IPTN was dependent on foreign supply for both raw material, such as aluminium, and high value-added components, such as engines, avionics and combat systems management. The company had to form a special team to encourage the emergence of a local supply chain, but with only limited success due to the strict standards of certification.[216] In 2002, the company confessed that production of the Bell helicopter still used 50 percent imported materials.[217] PT Pindad is no different, having been dependent on foreign technology from high precision machinery to raw materials for munitions production.[218] Whereas PT Pal has cultivated around 200 subcontractors, but these are mainly for the supply of low technology and consumables like cable, paint, and interiors.[219] Table 5.10 below summarises the contribution of offset to supply chain creation.

Table 5.10 Offsets Impact on the Creation of Supply Chains in PT DI, PT Pindad and PT Pal

Offset	PT DI	PT Pindad	PT Pal
1st stage	No	No	Yes, low value
2nd stage	No	No	Yes, low value
3rd stage	No	Yes, low value	Yes, medium/high value

Source: Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

In the first offset stage, the three defence industries started to manufacture military equipment to substitute imported products such as fixed wing aircraft and helicopters, fast patrol boats, attack rifles and ammunition. They contributed to arms procurement worth IDR 1.1 trillion equal to USD 1.2 billion across 1983-1993.[220] Local content in transport aircraft was claimed to have risen to 80 percent by 1985[221], but this referred only to the aircraft frame and excluded high value added systems and subsystems. Similarly, the contribution of local content to patrol boats has not surpassed 17.5 percent.[222] This reflects the high degree of dependency not only on the import of high value components - from engines and avionics to combat systems - that the three firms chose not to master, but there is also dependency on raw materials like steel plate and aluminium.[223]

The second offset stage saw no significant additions to supply chain creation, mostly due to the fact that the vendor supplied all the materials used in the offset programme when the activities were limited to assembly only. This is inevitable when the domestic industry is positioned as a subcontractor, with no influence on decision making related to procurement.[224] The third offset stage offers a similar story, given that the three firms were positioned as subcontractors under the lead integrators of foreign companies. PT Pindad, however, managed to increase local content in land systems production due to the contribution of local subcontractors. While the company manufactured the monocoque body along with small parts like axles for the panzer, domestic subcontractors, like PT Tamindo Permai Glass, produced bulletproof glass and PT Indopulley Perkasa produced flat rubber tires.[225] PT Pal acknowledges that the local content in PKR production will not surpass the average local content ratio of 17.5 percent.[226]

Promoting the supply chain through offset has not produced any meaningful outcome apart from the emergence of low value domestic subcontractors. Arguments that local supply chains could exist save at higher prices - as opposed to foreign imports that are competitive but low in resilience - have not convinced the main customer to pay the premium cost.[227] Efforts to establish supply chain linkage among strategic industries - such as PT Pindad, PT Pal, and PT Krakatau Steel to link special steel and production of land systems vehicles and warships - have failed because in order to meet the requirement for military standards a company has to invest in new equipment. This investment is not profitable when guarantees on sustainable orders from the government are absent.[228] High barriers to entry and the absence of government incentives have dampened efforts to cultivate small and medium enterprises for defence production.

Lately, however, there has been some participation of domestic subcontractors in offset programmes. PT LEN will be participating in the production of combat management systems for PKR, in cooperation with Thales. The company previously developed combat management systems, dubbed *MANDALA*, which upon receiving certification from Indonesian navy R&D (*Dislitbang AL*) have been fitted into the navy's fast missile boats.[229] It is important to note that private SMEs also engage in the high technology sector, such as PT Infoglobal that develops avionics for fighter jets and PT T&E Solutions that provide simulators for both aircraft and land systems. These kinds of SMEs need to be involved in future offset programmes.

5.5.5 Exports

Offset's contribution to promoting export is measured by the growth in export sales from the local company acting as lead integrator and as part of a global supply chain or as a subcontractor (chapter 3 p. 152). While the vendor often forbids export to third parties by retaining the license, export as a subcontractor – which signifies the vendor's trust in the quality of domestic production – is more likely to be achieved. In both areas, PT IPTN/PT DI stand out among the strategic industries. Only 12 years since its establishment, PT IPTN has managed to secure export of transport aircraft and has also received Boeing and Airbus' acknowledgement as qualified bidders and secured orders to manufacture primary structures of Boeing aircraft in 1986 (see p.221). Indonesian arms transfers are recorded by SIPRI only recognise the export of aircraft products. Indeed exporting as part of a global supply chain might only be applicable in the aerospace business, but not necessarily in shipbuilding and land systems due to different modes of production.[230] According to PT Pal, the most likely form of export in cooperation with the foreign vendor is co-production with a division of labour where work is on separate sections of the ship. Table 5.11 shows the impact of offset in promoting exports in the three firms being surveyed.

Table 5.11 Offset's Impact on Exports in PT DI, PT Pindad and PT Pal

Offset	PT DI	PT Pindad	PT Pal
1st stage	Yes	No	No
2nd stage	No	No	Yes
3rd stage	Possibly	Possibly	N/A

Source: Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

The first offset stage saw different impacts on exports from the three firms. Offset in PT DI was directed at exports of components of the F-16 but no subsequent orders after the conclusion of the programme. Whereas offset in PT Pindad and PT Pal was not directed to exports in the short term. The second offset stage saw no exports attached to the offset programmes in PT DI and PT Pindad, despite further exports secured by the vendor (see p.228 and p.239). Export was a surprising outcome of offset pertaining to license production of the LPD in PT Pal, because the vendor actually did not provide the license to export. Regardless, the company's success to export a vessel to the Philippines was achieved even though it retained a high dependency on the value added components of the ship. It is also possible that South Korea will have its fair share in the supply of components to in PT Pal's possible future exports.[231]

The third offset stage sees more effort to attach export promotion to offset programmes. PT DI has been negotiating for the marketing of the C 295 in the regional market, though nothing has come from this yet. PT Pindad and Nexter are planning to export the Komodo as a platform for Nexter's self-propelled gun to Vietnam (see p. 239). While offset programmes in PT Pal are still a work in progress - thus its potential for export is yet to confirmed - PT Pal expects that Damen will familiarise itself with Pal and engage the company in the production for export to third countries. Even when export does not happen, attaching export to the strategic objectives of offset could be beneficial for the industry. PT Pindad, for example, gained new knowledge on subcontracting for foreign vendors and new testing methods to meet requirements of foreign users. Hence, the company has risen to higher standards.

5.5.6 R&D

Offset's contribution to R&D is measured by the participation of the vendor in the new R&D venture created in the buyer country and the R&D programme created as a consequence of technology transfer through offset (chapter 3 p.153). Unfortunately no impact has been made in this area despite three stages of offset, which could be interpreted as follows. First, there has been a lack of effort to include R&D as a strategic objective of offset. Most of activities under the offset programmes have been around direct offset, focusing on licensing, co-production and assembly. This is understandable considering that R&D was not a priority in the early period of industrialisation (see chapter 4, p. 177). As a consequence of such policy, there has been a deficiency in the technology absorbing capacity of the three firms. This condition has worsened during the second offset stage, when industry was not able to maintain a dedicated R&D unit and invest sufficiently. Second, the weakening influence of BBPT during the second and third offset stage (see p.211) as well as no access to the long-term defence procurement plan puts industry in doubt as to which direction R&D should follow and where to put expensive investment associated with it.[232] Offset's contribution to R&D is encapsulated in Table 5.12 below.

Table 5.12 Offset's Impact on R&D in PT DI, PT Pindad and PT Pal

Offset	PT DI	PT Pindad	PT Pal
1st stage	No	No	No
2nd stage	No	No	No
3rd stage	No	No	No

Source: Fieldwork Research in Bandung, Jakarta, and Surabaya, April 2014-August 2015

In the first offset stage, most of the offsets have been directed at establishing manufacturing capability and to gain international recognition on the quality of domestic production. The second offset stage saw no contribution of offset to R&D because priority was given to capitalise on the industry's idle capacity. For industries struggling to stay afloat, R&D was not a priority they could afford (see p.245). The third offset stage has been criticised as 'reinventing the wheel', eg. PT DI's C-295 programme was said to be a stretched-out version of the CN-235, rather than a technological break-through.[233]

The absence of offset contribution to the strategic industries is a reflection of the limited local technology absorptive capacity and the difficulty to move up the ladder of production, from adopter of technology to innovator.

5.6 Implications for Defence Industrial Policy

5.6.1 Offset Implementing Regulations: Government Regulation No. 76 Year 2014 on Offset and the Upcoming Defence Minister Regulation

Despite decades of offset practice, Indonesia neither has a guideline nor a standard policy - such as a threshold, multiplier or a penalty - as a reference for policymakers and the strategic industries. This explains the inconsistent application of offset across the three offset stages. Offset in the absence of formal regulation can be negotiated when dedicated human resources are available. Furthermore, when the vendor understands the importance of local content as part of a marketing strategy. In many cases the vendor exploits the absence of offset regulation. On the other hand, a formal offset policy would not be beneficial when it is used only as a stamp to legitimise arms procurement. Industry believes that mandatory offset is only as effective when it is mandatory and has a strong influence in determining the outcomes of procurement bids.

While offset has become mandatory under Law No. 16 Year 2012 on Defence Industry, its effectiveness depends on the clarification of many elements. First, the Law does not define the practical elements of offset other than the percentage of offset, which is 85 percentcountertrade of contract value -with offset forming a minimum 35 percent. Without a threshold, offset must be implemented as a blanket policy, covering all procurement regardless of their value. The repercussions from such an interpretation of policy will create massive complications to the procurement body – which has been under pressure to expedite the procurement process. Second, the Law specifies the need for a number of follow-up regulations to detail the implementation of offset. The answer to this is Government Regulation No.76 Year 2014 that clarifies some policy elements of offset, such as the multiplier factor, eligible offset receivers, as well as technology valuation. Unfortunately, the Regulation also falls short in providing further details. Third, neither the Law nor the

Regulation specifies which stakeholder is in charge of the implementation of offset. The offset policy is to be formulated by KKIP, but the institution depends on its secretariat in the MoD to do its daily work. Indeed a temporary understanding has been reached between BARANAHAN - the procurement agency - and DIT TEKINDHAN - the management agency of defence technology and industry, as well as the secretariat of KKIP - but this is unlikely to be satisfactory process.

Despite the issuance of Law No.16 Year 2012 and Government Regulation No.76 Year 2014, many elements of offset implementation remain unexplained. The Indonesian MoD - as the institution in charge with offset policy formulation - is now preparing the next step: the Defence Minister Regulation on Offset. But there is concern that the government has been too focused on preparation of the offset regulatory framework, which remains a work-in-progress for the past five years since the first offset policy formulation began back in 2010. Preparation on human resources should run in parallel with the regulations.

5.6.2 Wider Offset Issues

The inconsistencies in offset implementation across procurement life cycles have affected the contribution of offset. Offset negotiation has not been optimal in the absence of agreement between government and industry on strategic objectives and the direction of offset. In many cases, offset demands have been rushed into negotiations after a procurement contract is agreed. Vendors have felt trapped, and are not be able to offer the best-offset package. Earlier engagement of potential offset receivers prior to the procurement negotiations must be considered. Evaluation of offset has also been absent, hence no data exist on the impact of offset and the associated premium cost. While offset policy elements will be addressed with further policy formulation, there are other wider issues that need to be considered.

First, is the need to determine strategic objectives of offset. Determining offset objectives is not only a matter of synchronising the different interests of stakeholders, but also of interpreting grand strategy –such as long term technology policy, arms procurement policy, as well as industrial development planning - and there is a need to make outputs measurable in terms of tangible metrics, such as employment, skill enhancement, technology transfer, exports, local supply chains and R&D. For this purpose, offset needs to be made flexible and not too focused on direct offset that revolves around license production, co-production and assembly work. Furthermore, there is a need to engage the lower tiers of the strategic industries to optimise the benefits of offset.

Second, the question needs to be addressed on how to enforce offset in the most effective way possible. Indonesia's arms procurement has been small in number and via diversified suppliers, which put the country in a weak position to negotiate offset. To use offset as a determining factor in procurement bids has been ruled out. A possible way to increase the country's bargaining position is by elevating the procurement volume and rationalising the number of suppliers. Furthermore, there is an urgent need to improve the domestic technology absorptive capacity in order to reduce the risk of offset failure and minimising the premium cost created by the technology gap between the vendor and offset receiver.

Last, but not least, the implementation of offset will face challenges from those disadvantaged by its presence. Offset requires careful institutional scrutiny and monitoring by independent auditing authorities, to disenfranchise those with the potential for corruption. In order to 'effectively' implement offset, government must consider the development of transparency and accountability in long-term policymaking in all its diverse dimensions, eg technology, procurement, civil-military industry, dual-use modelling, as well as socio-economic aspects, rather than focusing solely on a mono-directed defence policy. In this light, offset may actually lead to more accountability in arms procurement, an area traditionally characterised by secrecy.

Reference and Notes

[1] Willett, S. and Anthony, I. (1998) 'Countertrade and Offsets Policies and Practices in the Arms Trade', *Copenhagen Peace Research Institute Working Paper*, 20.

[2] Palia, A.P. (1992) 'Countertrade Practices in Indonesia', *Industrial Marketing Management*, 21, pp. 273-279.

[3] Siahaan, B. (2000) *Industrialisasi di Indonesia Sejak Hutang Kehormatan Sampai Banting Stir*. Penerbit ITB.

4 Interview: A1, Jakarta, Fieldwork Research (April 2014)

5 Through barter with communist countries Indonesia was bound to purchase commodity, but what Indonesia actually need was convertible foreign currency. Atmakusumah (eds.) (1997) *Tajuk-tajuk Mochtar Lubis di Harian Indonesia Raya Seri 2: Korupsi dan Ekonomi, Pendidikan dan Generasi Muda, Hukum, ABRI*. Jakarta: Yayasan Obor Indonesia. Citing Online Resource (http://books.google.co.id/books?id=Ydcpl4eGLBwC&pg=PA159&dq=barter+indonesia+soekarno&hl=id&sa=X&ei=0iHCU7mwIZOPuASjgoLoBQ&ved=0CB0Q6AEwAA#v=onepage&q=barter%20indonesia%20soekarno&f=true) (Accessed in 10 November 2014)

6 The overall packaged consisted of Government Regulation Number 1 Year 1982, four Minister of Trade Decisions, Six Minister of Finance Decisions, two Minister of Connection Decision, three Bank Indonesia Decision, as well as eight Bank Indonesia circulation letter.

7 The policy obligated foreign contractor that win government procurement bid valued more than USD 800,000 to purchase equal value of eleven non petroleum product from Indonesia, among others are plywood, sawn timber, and processed woods. See Prahasto, H., and Nurfatriani, F. (2001) 'Analisis Kebijakan Penyediaan Kayu Dalam Negeri', *Jurnal Sosial Ekonomi*, 2(2), pp.111-138.

8 The documentation of the regulation itself cannot be found. Therefore, reference is made using secondary source, in this case, Siregar, Z. and Mardjoko, T. (1989) 'A Case Study on the experience of Indonesian in the field of countertrade', in: *Islamic Development Bank conference on countertrade*.

9 Parsons, J.E. (1985) 'A Theory of Countertrade Financing of International Business', *Working Paper*, Alfred P. Sloan School of Management, MIT. Neighboring countries like Malaysia issued its own countertrade policy in 1982, which was the same year Indonesia issued its own policy. The Philippines followed by issuing its own countertrade policy in 1993.

10 The policy specified the threshold application of countertrade in government procurement with value IDR 500 mn, financed by state budget or export credit. No multiplier was known as one-to-one ration against FOB value of imported goods was applied. See Siregar, Z. and Mardjoko, T. (1989) *Op.Cit.*

11 Presidential Decision Number 16 Year 1994. Citing Internet Resources, (http://itjen.kemhan.go.id/sites/default/files/keppres_16_1994.pdf.)(Accessed in 2012). Countertrade reached its peak in 1992, 1993, and 1994 at value of USD 1.43 billion, USD 1.03 billion, and USD 1.05 billion respectively.

12 Interview: A2, Jakarta, Fieldwork Research (June 2014)

13 Habibie, B.J. (1978) 'Technology in Development'. In: *presentation in the Joint Command and Staff College*, Bandung, 3 February 1978.

14 Habibie, B.J. (1982) 'Science and Technology and Nation Building'. In: *speech in front of Keidanren,* Tokyo, 1982.

15 Matthews, R. (2004) in: Brauer, *Op.Cit.*p.97

16 This modernisation trend was motivated by reduction in US military presence in the region. Cohen, J. and Peach, A. (1994) 'The Spread of Advanced Combat Aircraft', in: Forsberg (ed) *The Arms Production Dilemma: Constraint and Restraint in the World Combat Aircraft Industry*. Centre for Science and International Affairs, Harvard University.

17 Habibie, B.J. (1995) *Op.Cit*.

18 Interview: B1, Bandung, Fieldwork Research (June 2014)

19 It has been confirmed that neither BPPT nor industries have aggregate data on offset agreement during 1980s-1990s. There is serious archival and knowledge management issue in the government and industry. All interviews confirmed this absence of aggregate data on offset. One respondent even went further to say that "Indonesia is a bad case study of offset", referring to the absence of programme record in government institution. Similar difficulty is faced when author try to confirm the number of offset programme in the post economic crisis and post issuance of 2012 Law on Defence Industry. A formal inquiry to the Indonesian MoD to access such data was rebuffed.

20 Palia, A.P. (1992) Countertrade Practice in Indonesia. *Industrial Marketing Management* 21. 273-279.

21 Palia, A.P. (1992) *Ibid*.

22 The year 1998 was chosen as it marks the end of Soeharto's New Order, and despite the same year also witnessed Habibie's rise as President, the idea of PMP and strategic industries was effectively frozen since.

23 Interview: B2, Bandung, Fieldwork Research (June 2014)

24 Interview: C1, Surabaya, Fieldwork Research (April 2013).

25 None of respondents interviewed during the research knows about the existence of offset policy prior to Law No 16 Year 2012 on Defence Industry.

26 Other respondents also share the same sentiment on Habibie's centrality in offset, albeit majority could not depict exactly what and how his influence works.

27 Interview: B3, Bandung, Fieldwork Research (June 2014).

28 Habibie's close relationships ness to Soeharto was built upon trust and respect. To put in his own words: Habibie was allowed to do anything short of revolution. Habibie, B.J. (1995) *Op.Cit*.

29 Interview: B2, Bandung, Fieldwork Research (June 2014)

30 Chaniago, A. (1990). *Op.Cit.*

31 Interview: B1, Bandung, Fieldwork Research (June 2014).

32 Interview: A3, Jakarta, Fieldwork Research (July 2014)

33 Interview: B1, Bandung, Fieldwork Research (June 2014). Offset in this regard was aimed at taking over subcontractor's work, not the prime integrator's work. The challenge in applying this is that one needs to know the cost structure of prime integrator.

34 Interview: A3, Jakarta, Fieldwork Research (July 2014)

35 Habibie, B.J. (1995) *Op.Cit.*

36 The offset value of 35 percent in F-16 offset was taken from flyaway cost and not overall procurement cost. See Chaniago, A. (1990) *Op.Cit.*

37 Interview: A2, Jakarta, Fieldwork Research (June 2014); Interview: B1, Bandung, Fieldwork Research (June 2014); Interview: A3, Jakarta, Fieldwork Research (July 2014). 1983 countertrade policy also stated that there is no multiplier but 'one-to-one ration' to value of imported goods is applicable.

38 IPTN had ben given a factor of 2.5 in technology transfer, out of 1-15 scale from best to worst. General Dynamics, the manufacturer of the aircraft, had become the only company to earn factor of 1. See Abubakar, U. (1990) *The Technology Transfer Application in the Republic of Indonesia*. Masters Thesis, Naval Postgraduate School Monterey.

39 'Imbaldagang Membangun Ekuitas pasar global', *Mediaindag*, No.1430, 2003, Bagian Proyek Pengembangan Komunikasi dan Publikasi Industri dan Perdagangan. Available at: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=0CDYQFjADahUKEwi6oISPjLPIAhUDG44KHZFJBgw&url=http%3A%2F%2Fwww.kemenperin.go.id%2Fdownload%2F20&usg=AFQjCNHRNmiHhn5WYxMROCd4dmBhW8HUbQ (Accessed 24 April 2014)

40 The minister's visit was to discuss bilateral cooperation in industry, trade, and defence with counter trade mechanism, which also applicable to arms trade. 'Megawati Menandatangani Imbal Beli Sukhoi', *Liputan Enam*, 23 April 2003. Available at: http://news.liputan6.com/read/53399/megawati-menandatangani-imbal-beli-sukhoi (Accessed in 10 November 2011)

41 Approximately 30 non-petroleum and mineral commodities were exported to Russia, to include textile, garment, chocolate, Palm oil, coffee and rubber. See 'Menperindag: Imbal Dagang Sukhoi Dikoordinasi Bulog', *Tempo*, 28 May 2003. Before the deal was clinched, however, the minister of

trade met the chief of armed forces to introduce the mode of payment to TNI's arms procurement programme from Russia. Available at: http://www.tempo.co/read/news/2003/05/28/05618680/Menperindag-Imbal-Dagang-Sukhoi-Dikoordinasi-Bulog (Accessed in 10 November 2011)

42 'Kedatangan Sukhoi Tak Perlu Disesalkan', *Suara Merdeka*, 28 August 2003. People's Representative Body created a task force to investigate the event, dubbed 'Sukhoigate'. See also 'Kasus Sukhoi Mirip Asramagare', *Pelita*, 1 November 2014. Available at: http://www.pelita.or.id.baca.php?1d=14960 (Accessed in 10 November 2014)

43 Discussion: nn, staff of agency for government procurement policy, LKPP, Jakarta, 2013. Fieldwork research.Local content was recorded only in infrastructure related project.

44 Keliat, M., 'The Future Direction of Defence Cooperation', In: Multazam, A. *Diplomasi Pertahanan Indonesia Terhadap Korea Selatan*. Undergraduate thesis, FISIP UI, 2010.

45 Fieldwork research at PT PAL, PT DI, PT Pindad in 2014 confirmed this.

46 In 2004, Chief expert of Sukhoi Aviation Holding Company said that Russian is okay to adopt countertrade, and uttered possibility of technology transfer and developing cooperation with Indonesia. 'Russian cozies up to RI defense industry'. *The Jakarta Post*, 27 November 2004.

47 Discussion during offset conference, organised by Indonesian MoD, 29 November 2010. It was suggested that because Indonesia use export credit and bought Russian technology in small number, she did not have the bargaining position to demand offset. The misunderstanding revolves around the assumption that offset cannot be demanded when using export credit or FMS in the procurement.

48 During this period, BPPT managed to halt a number of procurement from abroad that was proven to be counterproductive because comparable technology has been produced by domestic industry. This shows that despite the reduction of its role, BPPT is still active in monitoring the selection of technology to adopt.

49 'Defence Minister told to restructure office', *The Jakarta Post*, 6 November 2004.

50 Bandoro, B., 'Politicization of Weapons procurement', *The Jakarta Post*, 26 June 2003

51 Defence Minister told to restructure office', *The Jakarta Post*, 6 November 2004.

52 Defence Minister Regulation No.15 Year 2009 on the Management of Industry and Technology. Availabe at: http://www.hukumonline.com (Accessed 14 July 2015)

53 Article 43 paragraph (5) of the law stipulated that procurement from abroad can only be done in accordance to the following preconditions: first, it mandates participation of defence industry; second, the mandatory transfer of technology; third, mandatory countertrade, local content, and/or offset equal to at least 85 percent of procurement contract value; fourth, local content and/or offset referred to in the previous precondition must equate to 35 percent of countertrade value, which will be increased at 10 percent rate every five years. Article 43 paragraph (9) of the law also stipulated for supporting regulation, namely a government regulation, to regulate the details and mechanism of countertrade.

54 Discussion with A4, Jakarta, Fieldwork Research(May 2013).In consequence, there is certain degree of transparence and accountability to follow. The lack of which will hold the executor to the risk of persecution.

55 Three offset cases during 2000-2003 are KT-1 Wong Bee, LPD from South Korea, and Tarantula IFV. Seven offset cases during 2010-2013 are and Chang Bogo submarine from South Korea, F-16 upgrade from the US, N-295 transport aircraft from Spain, Guided missile destroyer escort (PKR) from the Netherlands, Caesar Howitzer from France, Mistral SAM from France.

56 Interview: C1, Surabaya, Fieldwork Research (April 2013).

57 Interview: C1, Surabaya, Fieldwork Research (April 2013).

58 Industry under MoIT was forced to focus solely on generating profit on short-term basis, an area in which strategic industry fell short. Ministry of Defence as the biggest user of defence industry product was left with no clear authority in the management of defence industry.

59 'Pemerintah Rumuskan Revitalisasi Industri Pertahanan', *Media Indonesia*, 8 October 2010.

60 'Sidang Pleno ke VII Komite Kebijakan Industri Pertahanan', *Defence Media Center*, August 2012. Available at: http://www.dmc.kemhan.go.id/index.php?option=com_content&view=article&id=1383:kkip-menggelar-sidang-pleno-ke-vii&catid=34:politik-a-hanneg&Itemid=5929 (Accessed December 2014)

61 Interview: A5, Jakarta, Fieldwork Research (2013)). Critics said that task forces created under the Committee did not work according to the plan and its members are lacking in commitment.

62 Interview: A5, Jakarta, Fieldwork Research (2013)

63 Interview: A5, Jakarta, Fieldwork Research (2013)

64 See Presidential Decree No 54 Year 2010 and Defence Minister Decree No 17 Year 2011.

65 See Presidential Decree No 54 Year 2010 and Defence Minister Decree No 17 Year 2011.

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6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

This thesis begins with a broad sweep of the literature from economic development to the specific themes of technology development and defence procurement, with emphasis on strategic choices available for latecomer developing countries grappling with problems of underdevelopment. To enable development to be launched and sustained, as the literatures suggests, capital and labour accumulation as well as technological progress are the primary factors in stimulating growth. Technological progress can be initiated through technology innovation or imitation. The first of these factors is characterised by a longer timeframe and a bigger risk, whilst the second entails the danger of greater dependency on foreign technology. The transfer of technology can be obtained through various conduits, but all oblige the state to be open to international trade. To ensure the success of adaptation and innovation, the state should to have a certain level of technology absorptive capability, in which a strong R&D base is fundamental. The other challenge is to adopt the right technology through the appropriate channel. For latecomers, state intervention through technology development policy is essential in the absence of thriving private sectors.

Public procurement is a policy tool of government in both industrialised and industrialising countries, which is held to be useful for promoting innovation and supporting industrialisation. Its significant value renders huge influence onthe market. One element of public procurement is arms acquisition; whereby government mostly acts as the only buyer (monopsony) thus has direct influence on the structure and survival of domestic defence industry. Military technology is considered strategic due to its leadership in leading edge technology and spin-off potential; so much so that defence industrialisation is viewed as a technology locomotive that influences technical progress in a country. Technology transfer from arms procurement is therefore viewed as an imperative.

Defence offset emerges from the power of the buyer's market and becomes a conduit for transfer of not only military technology, but also dual use technology. Moreover, globalisation of arms production and export means greater access for developing countries to participate in the global supply chain. This is a partial panacea for a state's dilemma in distributing scarce resources between defence and development across the broader economy. The interplay of these phenomena brings development and defence to a new level: offset (military activity) has a contribution to the broader economy (development) through skills enhancement, job creation, diversification, creating linkages, transfer of technology, new market opening, access to global production network and dual-use industrialisation. Through offset as compensatory arrangements, military spending is no longer seen as parasitical drain on the state, but a sector that generates real economic benefit.

This thesis also discusses the conceptual and empirical aspects of offset. As the literature in chapter 3 suggests, offset is a flexible concept that can be moulded in accordance to the specific interests of its stakeholders. Perceived as a part of countertrade, offset has grown to be the most important of this rubric's various reciprocal-trading activities. In practice, offset varies widely across countries, whether in relation to objectives, strategies, or policies. This arguably contributes to the difficulty in evaluating the success of offset; and this is in addition to the fact that offset in arms procurement is the subject of much secrecy. Offset is implemented through a lifecycle that mimics that of procurement, hence offset can be divided into pre-offset planning, negotiation, implementation, and evaluation. From the literature in chapter three on comparison of offset evaluation methods, a number of variables have been extracted as offset success indicators; these being employment-generation, skill-enhancement, technology transfer, sponsorship of value chain creation, export promotion, and R&D. Offset outcomes can lead to an array of results, including at the extremes, success and failure.

The Indonesian context is central to this study, highlighting the development and technological planning that has occurred in the country. The 'context' portrays the tapestry of Indonesia's technology development and industrialisation since the independence through to the end of Soeharto's New Order. The first industrialisation effort under Soekarno failed miserably due to political instability and constant military threats. The second industrialisation effort, began as Soeharto took power and ended at the time of the 1997 crisis, having been influenced by several factors.

First, competition of influence between economic nationalist and liberalist political factions nuanced governmentpolicy influencing development and industrialisation choices. Second, two larger-than-life figures, former President Soeharto and Dr Habibie, shaped the course of industrialisation and technology development through the idea of economic and industrial take-off and the so-called ladder of production. These processes were implemented through selected strategic industries acting as a vehicle for the progressive manufacturing plan and a series of government subsidies to ensure economic scale of from the domestic market was achieved. It is worth noting that accelerated industrialisation was implemented not by economists but by the engineers at the BPPT. Consequently, due to their engineering backgrounds, transfer of technology was given a central role in accelerated industrialisation. Third, politico-militarys factors allowed the establishment of dual-use industry as the encapsulation of the military's contribution to development in general and accelerated industrialisation in particular. Demand from military modernisation was used to support the development of strategic industries, aimed at exploiting technology transfer and scale. This began to define the role of offset in the Indonesian arms procurement process.

Following the above contextual backdrop to this study, the aim of the study has been to analyse how strategic industrialisation –which later became defence industrialisation- has been developed and implemented in Indonesia, including the contribution of offset at different stages of its life cycle: development, survival, and revitalisation. Offset contributions to strategic defence industrialisation was evaluated using six performance metrics, namely, employment-generation, skill-enhancement, technology transfer, sponsorship of local value chains, export-promotion, and R&D.

6.2 Conclusions

Based on the findings of the analysis conducted in chapter five, the following conclusions are offered:

1. Offset does make a positive contribution to strategic industrialisation, although its significance varies from one industrial sector to another and across different

offset periods: First Stage 'development' (1986-1998), Second Stage 'survival' (1998-20010), and Third Stage 'revitalisation' (2010-) (see chapter 5 pp.206-220). In general, areas in which offset contribution have been felt are skills enhancement and technology transfer. However, offset's contribution has been minimal in employment-generation, the creation of local supply chains, and export, with no impact at all on the promotion of local R&D capability.

2. Offset did not contribute to employment in the First Offset Stage (1986-1998) (chapter 5 pp.248-250). Offset was rather used to create work for existing employees, hence retaining jobs. This is similar to the employment in the Second stage two of offset development (1999-2010), when strategic industries were forced to retrench significant numbers of its employees to rationalise idle production capacity. While offset could have been used as a mechanism to retain high-skill jobs, the volume of work generated by offset was insufficient to prevent brain drain. The contribution of offset to employment creation rose in Third Offset Stage (2010-2014), when all three industries faced the challenge to replacing aging employees.

3. Offset did contribute to skills-enhancement through both overseas and local training and technical assistance (chapter 5 pp. 250-252). Overseas and local training have served significant numbers of employees from the strategic industries, particularly from maritime industry that by nature engage generates big numbers of skilled workers in the manufacture of ships. While the early offset stages created basic new skills, such as assembly and manufacturing skills, the latter offset stages provide new skills to improve production and marketing, such as production design, risk assessment, advanced systems integration (including combat management and electronic warfare), and testing. Despite inflows of these valuable new skills, massive lay-offs during Second Offset Stage meant that the strategic industries lost significant human resources. Also, there was a stopgap in defence production in the absence of government orders and export sales, which meant that these skills were not sustained and honed -unless applicable to the non-defence sector.

4. Offset's contribution to technology transfer did occur in form of transfer of new and superior technology, comprising hardware, software, know-how, process, production, method, licensing, to language skills and disciplines associated with human quality. While technology transfer through offset was significant in the First and Third Offset Stage, it had hardly any impact during the subsequent stages (ch 5 pp.252-253). The technology transferred was not new and there was only limited possibilities for spin-off to the commercial sector to sustain its benefit. The Third Offset Stage bring in new technology to PT Pal and PT Pindad, but presumably 'reinventing the wheel' for PT DI. Despite many potential spin-off from offset, lack of financial ability prevented the maritime industry from exploiting this technology after the offset programme .

5. Offset failed to make a positive contribution to the development of local supply chains, as signified by the low level of local content and the lack of emergence of local subcontractors (chapter 5 pp.254-256). Offset fell short in this area, as all of the strategic industries retained high levels of dependency on imported material from low added value like steel and aluminium to high valued added technologies like engine, radar, turret, and so on. The highest barrier to creating supply chains lies in the aerospace industry. In the maritime industry and land system sectors, local content on average is around 17.5 percent and below 40 percent, respectively. This suggests that a wide gap exists between local industry ability and that of foreign contractors, as well as both the lack of incentive to enter subcontracting defence production work and participation of local tier one/two industries in offset programmes.

6. The contribution of offset on export of arms, -signified by growth in export sales as lead integrator and as part of the global supply chain- has been minimal (ch.5 pp. 256-257). This must be seen as a fundamental failure, because the primary objective of offset is to gain international acknowledgement as to the quality of domestic production. Even when exporters are the lead integrators, they are often not in the category of high technology supplier, thus suffering a continued high dependency on foreign high value added components. Opportunity to enter the global defence supply chain looks dismal when facing the cold fact that foreign vendors are pressured to relocate offset work to many other country buyers to

fulfil new offset obligations. While opportunities exist abound for the local aerospace industry to export as part of an OEM global supply chain, due to the nature of its production, land systems and the maritime sectors have not found a way as yet to do so. A different approach is necessary in defining the best form of export promotion and supply chain creation for each of the strategic industries.

6.3 Policy Recommendations

1. The main factor behind the failure of offset is inconsistent implementation of offset as a government procurement policy tool. While offset policy basically exists in all three periods, there were no guidelines that would have been useful in the absence of a dedicated offset body. There was also no stand-alone offset body to plan, negotiate, execute, oversee, and evaluate offset programmes. As a consequence, the absence of continuing records as well as transfer of knowledge within stakeholder organisations makes it difficult to evaluate and generate feedback to improve offset practice. Belatedly, Indonesia has issued Government Regulation Number 76 Year 2014 on the Mechanism of Countertrade, Local Content and Offset in the Procurement of Foreign Military Articles. However, this does not mean stakeholders comprehend the policy and implementation aspect of offset. In the absence of offset guidelines, foreign vendors are not aware of the importance of offset in the procurement bid nor they are confident to propose long-term programmes when no clear incentive is in place. Thus, it is recommended that the Indonesian government urgently create a dedicated offset body and offset guidelines for foreign vendors to understand the ground rules. Preparation of human resources to implement offset should run in parallel with the formulation of practical regulatory frameworks.

2. The failure of offset is partly linked to the absence of a common agreement on what is to be achieved by offset, in other words, 'strategic objectives'. This was clearly defined in First Offset Stage, targeting on international recognition of the quality of in-country production, job creation, skills enhancement, and technology transfer. In the later stages, strategic objectives have been indistinct. When industry fought for its survival in the absence of government support during the Second Offset Stage, offset had not delivered enough impact on job

retaining, skills enhancement, and local supply chain creation as well as export promotion, arguably critical to being competitive and maintaining or increasing sales. Under the Third Offset Stage, while the strategic objective of offset was linked to the industrial revitalisation and defence technology indigenisation pathways (known as 'seven national programme'), industries were still uncertain with respect to which sectors and which direct offset should attract investment. The current government needs to identify which technology policy should be the reference for offset, dual use or exclusively military channels, if the main purpose is to create an independent and internationally competitive industry, as prescribed in Law No 16 Year 2012 on Defence Industry.

3. In the First Offset Stage, negotiations had been more adaptable to variants of offset- both direct and indirect. However, this was missing in negotiation processes under later offset stages. Most offsets in Indonesia have been direct, linked to co-production or license production of the procured technology, thus self-limiting. This was arguably because government and user had more say on offset, while industry stood passively at the receiving end. Decisions had been made on ad hoc basis, with no clear reference to policy or objective. This has put industry in a disadvantageous position, having no ample time or resources to prepare for sustainable industrial development. There are certain risks and difficulties in absorbing direct offset, i.e. potentially disrupting procurement schedules and demanding massive investment at short notice as in the case of the LPD programme and PKR. Thus, it is suggested that negotiation of offset should be made more flexible and allow 'room for manoeuvre' for industry to come to the best-offset arrangement. While the state might determine the strategic guidance for offset, it should leave the negotiating process on a business-to-business basis.

4. A fundamental issue behind offset failure is the ability of industry to absorb new technology and spin--off technology to make benefits sustainable. Under First Offset Stage, when the strategic industries were given massive investment in top-notch facilities and human resources, technology absorption was not an issue especially when the level of technology transferred was on assembly and manufacturing. During subsequent offset stages, however, industries were not

able to maintain facilities, human resources, as well as R&D programmes; thus, absorbing offset became financially challenging. Where offset could benefit industry, it was viewed as a 'liability', especially when its value was not equivalent to the obligor's discharge of the liability. When offset is considered, the government needs to take into account the cost of offset to industry and other recipients. The government needs to have an estimation of offset cost and make a long-term commitment to share burden share with both domestic industry and the offshore vendor.

6.4 Recommendations for Future Research

1. This research programme faced an array of limitations to data access, and availability of both time and resources, hence the focus on only nine case studies. But there is actually a plethora of case studies waiting to be examined, from which best practices and lessons can be generated for future policy reference. For example, offset pertaining to the procurement of BAe's Hawk was used to support CASA in its bid for certification of the CN-235, which was vital for PT DI to export as lead integratorof the jointly developed aircraft. This kind of offset, which is not limited to license production and co-production under direct offset, offers flexibility that could be specifically-tailored to the needs of industry. This is an important direction for future policy research that potentially contributes to the optimisation of offset benefits to the strategic industries. Thus, it is recommended that future studies should incorporate case studies of indirect offset into analysis.

2. Further research should be undertaken to broaden the unit of analysis, not to focus solely on the lead integrator in the hierarchy of defence production but also to embrace the lower levels of both state-owned enterprises and private industries. Arguably, this is the main area where innovation can occur and arguably also where offset can exert more impact on employment, skills enhancement, technology transfer, export, and local chain creation. The involvement of PT Len -in cooperation with Thales- in providing Combat Management Systems in the PKR programme, is a relevant example that needs further study.

3. While offset is alleged to facilitate corruption, further study on Indonesian implementation of offset might prove otherwise. Arguably, offset could strengthen accountability in arms procurement decisions by forcing in more deliberation to balance basic procurement criteria and military judgement. In the absence of a life cycle approach to procurement and transparency in determining the specification of weapons procurement, offset could be the key element that provides a long-term foresight. When 'proper' offset is conducted, with reference to both long-term military procurement planning and industrial business plans, it actually helps to ensure that no ad hoc or sudden procurement can occur as often as has happened in the past. While offset may not be the determining factor in determining the outcome of a procurement bid, it must be a mandatory precondition for joining it. Thus, it is recommended that future research should adopt different angles on examining the correlation between offset in arms procurement and corruption.

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APPENDIX I - Preliminary Survey (December 2011- January 2012)

1. DATA OF RESPONDENT

1	Name of Respondent	
2	Position in the Company	
3	Name of Company	
4	Date and Place of Survey/Interview	

2. SURVEY ON OFFSET

No	Question	Answer
1	Who is the biggest offset provider in your company?/ *Siapa penyedia offset terbesar?*	
2	Which type of offset your company have received?/Model offset apa yang pernah perusahaan Anda terima? 1. JV/JV 2. Co production/Co-produksi 3. Subcontracting/Subkontrak 4. Collaboration/Kolaborasi 5. Others/Lainnya Which type do you think is the most effective?/*Model apa yang menurut Anda paling berhasil*	
4	Type of technology transfer received through offset/*Tipe teknologi apa yang didapat lewat offset* 1. Product/Teknologi produk 2. Process/Teknologi proses 3. Know-how/Teknologi know-how 4. Teknik manajemen 5. lainnya	

No	Question	Answer
5	Does technology transfer through offset produce/*Apakah transfer teknologi melalui offset menghasilkan* 1. Patent/paten 2. License/lisensi 3. Machines/mesin 4. Education/pendidikan 5. Training/pelatihan 6. Turnkey/turnkey 7. Foreign consultant/penyewaan jasa konsultan asing 8. Management participation/partisipasi manajemen 9. Technical assistance/bantuan teknis 10. FDI 11. JV 12. Collaboration/kolaborasi 13. Subcontracting/ subkontrak 14. Co production/co-produksi 15. Buy-back 16. Others/ lainnya	
6	Do you think technology transfer from offset can be obtained from other conduit?/ Apakah teknologi yang ditransfer melalui offset bisa didapatkan dari sumber yang lain	
7	Do you think technology transfer from offset has dual use potential?/ Apakah teknologi transfer melalui offset punya potensi dual-use atau aplikasinya hanya pada bidang pertahanan	
8	Does your company use technology transfer from offset to build local technological capability? (Explain the source of technology, type of technology, and type of works)/ *Apakah perusahaan Anda memanfaatkan teknologi transfer offset untuk membangun kapabilitas teknologi lokal (jelaskan sumber teknologi, jenis teknologi dan tipe pekerjaannya)*	
9	Does your company experience problems related to technology transfer from offset in production or operation? (provide the example and source)/*Apakah perusahaan Anda mengalami kesulitan yang berkaitan dengan teknologi offset dalam produksi atau operasi ? (berikan contoh kesulitan dan sumbernya)*	

No	Question	Answer
10	Does your company experience problem in technology sharing with foreign partner? (provide example and source)/Apakah perusahaan Anda mengalami kesulitan technology-sharing dengan mitra luar negeri? (berikan contoh kesulitan dan sumbernya)	
11	Does your company experience problem when facing the government on acquisition of technology? (provide example and source)/Apakah perusahaan Anda mengalami kesulitan berhadapan dengan pemerintah dalam rangka akuisisi/adopsi teknologi ? (berikan contoh kesulitan dan sumbernya)	
12	Does your company generate benefits form offset. Provide details of the benefits using company performance in the last 5 years, i.e. export, product/system innovation, employment, skills enhacement, local subcontracting, spin off, etc. */Apakah perusahaan Anda mendapatkan keuntungan dari offset. Misalnya dalam perbaikan performa? (jelaskan keuntungan itu dalam performa 5 tahun terakhir, misalnya ekspor, inovasi produk, proses system, penambahan kerja, peningkatan keahlian, penguatan basis subkontraktor lokal, aplikasi komersil)*	

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APPENDIX II - Offset Survey Form (April-May 2014)

THE CONTRIBUTION OF OFFSET TO INDONESIAN DEFENCE INDUSTRIALISATION

Since 2010, Indonesian government has been formulating a policy to pursue domestic industry participation, better known as 'offset', in foreign procurement. The objective is to achieve independency in arms provision and strong defence industry. This strategy mirrors what took place during 1980s and 1990s, when offset was used to assist strategic industry, predominantly PT IPTN, PT PAL, and PT Pindad, to move them up along the progressive manufacturing plan set by B.J Habibie. Question remains on the **true contribution of offset to the strategic industry and dual-use industrialisation.**

Curie Maharani, a PhD student at Cranfield University, is pursuing her research on the contribution of offsets. Curie holds Bachelor Degree from International Relations, University of Indonesia (UI), and Masters Degree from Defence Management Study, Institut Teknologi Bandung (ITB). She has worked to assist Ministry of Defence in offset policy formulation in 2013.

The objectives of the research are as follows: (1) to describe the offset policy, process, and problem (2) to determine offset contribution to dual-use industrialisation, by looking at: employment created and maintained, type of technology transfer, backward and forward linkages (such as product diversification, export, local supply chain creation), sustainability of offset benefits, and spin off (benefit from arms procurement to non-defence sector)

In order to carry out her research successfully, the researcher intends to visit your company/institution as offset receiver. The objective is to gather sufficient evidence to support research and compile the findings into a PhD thesis.

It would therefore be appreciated if your company/organisation would provide assistance and cooperation to Curie during her research.

For further inquiry:

curie.safitri@gmail.com (Curie Maharani)

DATA OF RESPONDENT

1	Name of Respondent	
2	Position in the Company	
3	Name of Company	
4	Date and Place of Survey/Interview	

1. **Offset's Practices/ Praktik Offset**

Please write down the type of offsets activities that your company had ever received related to arms procurement, procurement's value, year of procurement, offset's activities, offset's value, and offset discharge period. *Mohon tuliskan di dalam tabel berikut kegiatan ofset yang pernah anda terima berkaitan dengan pengadaan apa, nilai pengadaan, tahun pengadaan, penyedia offset, kegiatan offset, nilai offset, jangka waktu offset.*

No	Procurement/ *Pengadaan*	Procurement Value/ *Nilai pengadaan*	Year of Procurement/ *Tahun pengadaan*	Offset Provider/ *Penyedia offset*	Offset Activities/ *Kegiatan offset*	Offset Value/ *Nilai offset*	Offset Benefits for Industry/ *Keuntungan offset untuk industri*	Offset Discharge Period/ *Jangka waktu offset*
1								
2								

2. The Contribution of Offset in General / *Dampak OffsetSecara Umum*

No	Question	Answer
1	Which offset program methat you think is the most successfull in your organization, please provide reasons for your answer/ *Apa program ofset yang menurut anda PALING BERHASIL di organisasi anda dan mengapa dinilai berhasil?*	
2	What kind of offset that your organisation received?/ *Model offset apa yang organisasi anda terima?* 1. JV 2. Co-production/ co-*produksi* 3. Subcontracting/ *subkontrak* 4. Collaboration/ *kolaborasi* 5. Others/ *lainnya* Please provide example/ *Berikan contoh.*	
3	Type of technology transfer received through offset/ *Tipe teknologi apa yang didapat lewat offset* 1. Product/ *teknologi produk* 2. Process/ *teknologi proses* 3. Know-how/ *teknologi know-how* 4. Management/ *teknik manajemen* 5. Others/ *lainnya*	

No	Question	Answer
4	Did technology transfer through offset produce/ *Apakah transfer teknologi lewat offset menghasilkan*: 1. Patent/ *paten* 2. License/ *lisensi* 3. Machines/ *mesin* 4. Education/ *pendidikan* 5. Training/ *pelatihan* 6. Turnkey/ *turnkey* *7.* Foreign consultant/ *penyewaan jasa konsultan asing* *8.* Management participation/ *partisipasi manajemen* 9. Techncal assistance/ *bantuan teknis* 10. FDI 11. JV 12. Collaboration/ Kolaborasi 13. Subcontracting/ subkontrak 14. Co-production/ *co-produksi* 15. buy-back 16. others/ lainnya	
5	Do you think technology transfer from offset can be obtained from other conduit that could be more economical and effective?/ *Apakah teknologi yang ditransfer lewat offset sebenarnya bisa didapatkan dari sumber yang lain dengan cara yang lebih murah dan efektif?*	
6	Do you think technology transfer from offset that your organisation recieve can be obtained without offset?/ *Apakah transfer teknologi yang diterima organisasi anda melalui offset bisa didapatkan tanpa offset?*	

No	Question	Answer
7	Can you identify and explain variables that supports offset implementation throughout the following staged: /*Dapatkah anda mengidentifikasi dan menjelaskan variabel-variabel yang mendukung kesuksesan program offset tersebut dalam tahapan offset berikut*: 1. Offset planning/ *perencanaan offset* 2. Preparedness to receive offset/ *kesiapan penerimaan offset* 3. Negotiation and communication/ *negosiasi dan komunikasi* 4. Evaluation and government assessment/ *evaluasi dan penilaian pemerintah*	
8	Do you think offset planning has considered dual use potential of offset (can be applied in comercial field) or is it just for defence field? / *Apakah perencanaan offset mempertimbangkan faktor potensi dual-use (dapat diaplikasikan di bidang komersil) atau aplikasinya hanya pada bidang pertahanan?*	
9	Does your company use technology transfer from offset to build local technological capability? (Explain the source of technology, type of technology, and type of works)/*Apakah organisasi anda memanfaatkan teknologi transfer dari offset untuk membangun kapabilitas teknologi lokal (jelaskan sumber teknologi, jenis teknologi dan tipe pekerjaannya)*	
10	Does your company experience problem in absorbing the technology from offset? (provide example and source of problem)/ *Apakah organisasi anda mengalami kesulitan dalam menyerap teknologi yang didapat melalui offset? Bagaimana mengatasinya? (berikan contoh kesulitan dan sumbernya)*	
11	Does your company experience problem in technology sharing with foreign partner? (provide example and source)/ *Apakah organisasi anda mengalami kesulitan technology-sharing dengan mitra luar negeri? Bagaimana mengatasinya? (berikan contoh kesulitan dan sumbernya)*	

No	Question	Answer
12	Does your company experience problem when facing the government on acquisition of technology? (provide example and source)/ *Apakah organisasi anda mengalami kesulitan berhadapan dengan pemerintah dalam rangka akuisisi/adopsi teknologi ? (berikan contoh kesulitan dan sumbernya)*	
13	Does your company generate benefits from offset? i.e. perform enhancement/ *Apa keuntungan yang organisasi anda dapatkan dari offset, misalnya dalam perbaikan performa?* 1. Export/ *ekspor* 2. Product's innovation/ *inovasi produk* 3. Process innovation/ *inovasi proses* 4. System innovation/ *inovasi sistem* 5. Employment/ penambahan kerja 6. Skill enhancement/ peningkatan keahlian SDM 7. local subcontracting/ penguatan basis subkontraktor local 8. Spin off/ aplikasi komersil 9. Others/ *lainnya*	
14	What kind of offset benefits that sustain after the conclusion of offset discharge?/ *Apakah manfaat offset yang organisasi anda rasakan memiliki keberlangsungan setelah kewajiban offset selesai, melalui:* 1. Subcontracting/ *subkontrakting* 2. New collaboration between offset's receiver and provider unrelated to offset program/ kerjasama baru antara penerima dan penyedia offset yang tidak terkait dengan program offset 3. Others/ lainnya (sebutkan)	

3. Contribution of Offset per Case Study

No	Variable	Indicator	Example (please fill up in accordance tou your experience of offset engagement)/ *Contoh (mohon diisi sesuai dengan program offset dimana anda pernah terlibat)*
1	Employment (*lapangan kerja*)	Number of job created/maintained by offset (*jumlah tenaga kerja baru atau yang dipertahankan karena offset*) Number of quality job created/maintained by offset (*jumlah pekerjaan dengan keahlian tinggi/khusus yang diciptakan atau yang dipertahankan karena offset*)	
2	Skill enhancement (*peningkatan keahlian*)	Improvement in worker skills (*peningkatan keahlian) – jelaskan jenis keahlian tersebut* Education/training received by worker (*pendidikan atau pelatihan untuk pekerja)- jenis training, lama waktu, tempat*	
3	Technology Transfer (*transfer teknologi)*	Quality of technology transferred (*kualitas teknologi yang ditransfer*) New technology or old technology (*teknologi baru atau lama)* Superior technology/equal/inferior compare dto existing one in the company (*teknologi lebih tinggi/setara/lebih rendah dari kemampuan yang sudah ada di perusahaan*) Type of technology (*tipe teknologi*: metode, know how, know why, marketing, etc)	

No	Variable	Indicator	Example (please fill up in accordance tou your experience of offset engagement)/ *Contoh (mohon diisi sesuai dengan program offset dimana anda pernah terlibat)*
4	Value Chain	Number of component exported as subcontractor (*komponen yang diekspor sebagai subkontraktor*) Type of component and number (*Jenis komponen dan jumlah*) Number of component produced domestically and name of the components (*Komponen yang bisa dibuat dalam negeri untuk menggantikan komponen ekspor*) and number of component that is still dependent on import (*Komponen yang masih tergantung pada impor*) Backward linkage Domestic subcontractors (*Suplai komponen dari perusahaan domestik lain*)	
5	Export	Growth in export sales (*peningkatan jumlah ekspor*) Participation in global supply chain (*partisipasi dalam rantai suplai global*)	
6	R&D Sustainability	Participation of vendor in R&D ventures in buyer country (*partisipasi vendor dalam kegiatan R&D di Negara pembeli alutsista*) R&D programme created as consequence of technology transfer through offset (*Program R&D yang tercipta dari kemampuan yang terbangun akibat alih teknologi dari program offset*)	