

Supply Chain Management in SME's within the Defence/Aerospace Industry – a case of simplification or increased complexity?

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Abstract

This paper presents an overview of the rapidly changing nature of the European defence and aerospace industry. In particular the paper identifies a number of key issues associated with the dynamic of supply chain management in respect of Small to Medium-sized Enterprise's (SME's) at the 2nd, 3rd and 4th tier levels.

A number of issues are raised concerning the current/future relationships between SME's and prime contractors. Particular emphasis is placed on buyer/supplier power and the development of SME strategies in response to the industry changes.

The paper suggests a number of areas that need to be researched to investigate the developing view of strategy and strategic options for SME's in light of the industry restructuring within the context of the concept of strategic fit and stretch.

Introduction

The European defence/aerospace industry is currently undergoing a major restructuring with alliances, mergers and buy-outs being the order of the day. Although numerous factors contribute to this situation the main effect is linked to the end of the Cold War and the resulting reduction in defence budgets.¹ Although the US government defence R&D spending has fallen it has been less than is the case in Europe.²

Increasingly the onus for R&D is being placed on the prime contractors and governments are stepping back from this role in the UK under the PFI and PPP umbrella.³ To this end the key players in the defence industry see the need for increased size in order to take on this role and to be competitive within a global market.⁴ A blueprint for this approach has already been developed in the USA with the industry being condensed down to a few huge (by European standards) players.

The defence/aerospace sector has always been a major part of the UK economy and although one immediately thinks of companies such as BAE SYSTEMS (formally BAe), GKN, Vickers, GEC and Rolls Royce it must be remembered that they form the tip of the iceberg. The major effort in the industry typically comes from the huge number of Small to Medium-sized Enterprises (SME's) that support the key players. Prime contractors are developing new views of the industry resulting in the generation of strategic options that are re-defining the paradigm.⁵ However, it is equally important that the SME's take stock of this paradigm shift. As a consequence of industry concentration the large players are broadening their competencies and resource base through the process of acquisitions and mergers and are looking for relationships with key suppliers in the 2nd tier. This changing dynamic may require SME's to re-evaluate their view of strategy if they are to remain part of the defence sector in the longer term.⁶

In addition to this, in 1998, as part of the Strategic Defence Review, the Smart Procurement Initiative was announced.⁷ This was to be a means of improving defence procurement management processes. Whilst the initial application was seen as radical, it was to concentrate on major equipment procurement projects. However, the influence of Smart Procurement has been such that, it has begun to affect areas further afield in the defence environment, and may well affect SME's in the 2nd, 3rd and 4th tiers.

The drivers for change

The defence industry and the aerospace industry are inextricably intertwined given that many of the players are common to both industries. As such, in addition to the common drivers for change one must also allow for the fact that drivers specific to one or other of the industries will have a general impact on all companies within the industries.

The most commonly quoted driver of change for the defence industry has been the end of the Cold War. There were however, signs at the end of the 1980s that the steadily increasing pressure on the defence budget due to the increasing technological sophistication of combat equipment could not be sustained, particularly with the advent of *glasnost* and *perestroika* in the Soviet Union. The causes for concern were numerous and were greatly influenced by a number of other drivers such as:

- The escalating costs of social security spending in many countries, this contributed to pressure on governments to reduce defence budgets,
- The accelerating influences of technology development (especially in the area of information technology),
- Identification that increasingly the procurement systems were clearly failing to deliver the equipment either in acceptable timescales or within budget, or indeed failing on both counts.
- The costs of research and development made it difficult for companies, other than the largest prime contractors, to bear the up front costs associated with bidding for work.

- Recognition of customer-supplier relationships in the defence sector did not reflect the considerable improvements in performance that had been forthcoming in the commercial sector.
- A groundswell of awareness of best practice, in respect of supply chain management philosophies that had been delivering benefits to commercial organisations in respect of time, cost and performance.
- The introduction of Smart Procurement which has provided a vehicle for considerable change and development within the broader defence environment.

Other factors have also influenced changes in the industry including the future role of the armed forces, the nature of future conflicts and the increased use of high technology equipment.⁸ The idea that equipment and systems should be able to talk to each other has been around for some time although in reality very little interoperability has ever been achieved. As the digital battlespace expands⁹, and more countries move towards upgrading their armed forces to digital status, communications will be an important part of future warfare¹⁰ and will become of paramount importance as will industry co-operation¹¹. As military operations increasingly move to multi-national status it will become a necessity for equipment to have inter-operability.¹²

Industry response

By far the most dramatic response to the changing environment can be seen in the USA where the industry has a very different shape to that of a decade ago. Table 1 gives some indication of the joint venture, merger and acquisition activity in recent times

and Table 2 presents the current structure of the industry in terms of prime contractors in the USA.

Alliant Techsystems & Hercules Aerospace	Lockheed Martin & Loral
Lockheed & Martin Marietta	Raytheon & Chrysler Technologies
Rolls Royce & Allison Gas Turbines	Southwest Marine & Continental Maritime
Tracor & Lundy Tech Centre	GEC-Marconi & Hazeltine
Loral & Unisys Defence Operations	Tracor & Cordant
Litton & Imo	Boeing & Rockwell Aerospace and Defence
GM/Hughes & Alliant Techsystems Marine Group	GDynamics & Lockheed Martin Armament and defence systems
GDynamics & Bath Iron Works	Northrop Grumman & Logicon
Raytheon & E-Systems	Boeing & McDonnell Douglas
Allied Signal & Northrop Grumman precision products	Raytheon & Texas Instruments Defence Systems and Electronics Group
Logicon & Geodynamics	GDynamics & Computer Devices International
GM/Hughes & Litton-Itek	Raytheon & Hughes Aircraft Company
Litton & PRC	TWR & BDM
Litton & Sperry Marine	ITT International & Kaman Sciences
Gdynamics & Teledyne Vehicle Systems	Newport News & Continental Marine Ind.

Table 1 USA Mergers & Acquisitions: 1995 to 1998.¹³

Industrial Sector	Companies (1990)	Companies (1997)	% Budget change (1990-1997)
Expendable launch vehicles	6	2	-3
Fixed wing	8	3	-57
Rotocraft	4	3	-56
Satellites	8	5	77
Strategic Missiles	3	2	-86
Submarines	2	2	-3
Surface Ships	8	5	-49
Tactical Missiles	12	4	-44
-- Air intercept	4	3	-21
Tactical Wheeled Vehicles	6	4	43
Torpedoes	3	2	-91
Tracked Combat Vehicles	3	2	-48

Table 2 Changes in number of prime contractors in the USA.¹⁴

However, the Americans are not the only ones confronting major defence industry change, Europe is also undergoing major restructuring. Changes take place almost daily with the most significant recently being the merger of GEC Marconi and BAe (forming BAE SYSTEMS) and Thomson-CSF's purchase of Racal.

It is clear that one of the effects of the restructuring is a move away from the traditional nationally based industry in terms of R&D and production. Equally the influence of state ownership has reduced significantly in recent times, which in part is seen as a step to help the restructuring process, e.g. France, Italy and Spain.

In December 1997, the governments of the United Kingdom, Germany and France defined a vision of a new industry structure in the defence areas of systems, communications and electronics. Subsequently this initiative has been taken further and the interested parties have grown from the initial three to six. The current commercial activity seen in the industry is consistent with political initiatives as evidenced in the Letter of Intent between the defence ministers of France, Germany, Italy, Spain, Sweden

and the United Kingdom in July 1998. Following this meeting it was recognised that a number of significant implications needed to be addressed including:

- Security of information
- Security of supply
- R&D funding
- Defence exports
- Harmonisation of European requirements and needs.

The outcome of this complex situation is that governments are trying to ensure that national security is maintained and that they are able to respond to conflicts on a regional or international basis. They also have to make decisions about security of supply of strategically sensitive resources, a point that recently exercised the House of Commons Defence Committee with regard to the supply of propellant and the future of Royal Ordnance.¹⁵ Equally, governments recognise that in order to have a future, businesses need to be of a scale of operation and have sufficient sources of competitive advantage enabling them to take their place in the global market. The prime driver in this case is that the domestic market within a country is unlikely to be large enough to support the prime contractors and that their long-term survival will depend on successful exports in a highly competitive global marketplace.

The current situation in Europe is still in transition as reflected in the range of commercial structures delivering products including;

- Collaboration in terms of the 'virtual enterprise' working on a single product, e.g. Eurofighter (Typhoon).
- Joint ventures based on a range of products, e.g. Eurocopter
- Strategic alliances involving equity exchange, e.g. BAe-Saab
- Full foreign ownership of a defence business e.g. BAe-Heckler & Koch

Shape of the Industry

The industry restructuring reported in the press tends to focus on the large deals between the prime contractors. However, whilst the intrigue associated with this side of the business makes for good reading such changes have significant effects at all levels in the supply chain. Indeed, in this respect it appears that the recognition of the supply chain and the benefits that can accrue from integration of the various activities into a 'total process' perspective had not been acknowledged within the defence environment.¹⁶

Traditionally, the structure of the players in the industry in the UK has been triangular as depicted in Figure 1. Whilst the prime contractors sat at the top of the triangle the flow of information tended to span many tiers. In addition to this a firm's position could also change from one project to another. For example, it might be that GKN is the prime contractor on one project but they could be a 3rd tier sub-contractor on another where the prime contractor for the particular project is substantially smaller than GKN.

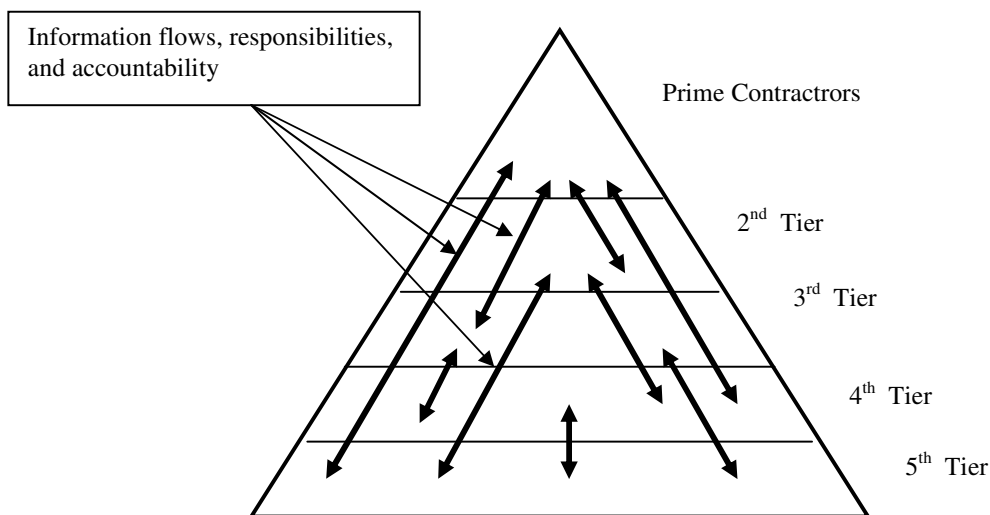


Figure 1. Supply chain communication before industry restructuring

A key point to note from the figure is that it does not represent the scale of the business conducted by the 2nd, 3rd, 4th and 5th tiers within the industry. These companies collectively described as SME's constitute the bulk of the industry both in terms of revenue generated and staff employed in the UK. The European Union definition of an SME is one employing less than 250 staff, less than £30m turnover and is not more than 25% owned by voting rights by another company. Figures for 1997 indicate that SME's constitute more than 80% of all companies supplying to the defence and aerospace industries. About 65% of defence and aerospace industry turnover is generated by SME's and they account for about 300,000 jobs in the UK alone.

In recognising the 'chain' of suppliers, invariably including large numbers of SME's, it has been highlighted that those activities that add value must be the central focus of attention whilst that those activities that incur cost or can be considered waste (*muda*) must be eliminated.¹⁷ This has been taken further in respect of lean supply chain philosophies that seek to gain the total perspective of the supply of items, components, equipment and service whilst undertaking detailed value-stream mapping.¹⁸

The concentration in the industry at the prime contractor level may be seen by many observers and in particular customers as a process of simplification, however, it also hides a wide range of issues that may have significant implications for SME's. One of the consequences of the industry restructuring is that the prime contractors are becoming fewer but much larger¹⁹ and as such will have benefits in terms of:

- Economies of scale
- Buying power
- Ability to spread risk
- Scope to provide complete solutions or systems.

However, as the prime contractors become larger they are also broadening their sphere of influence and the skill base that they can draw upon. For example, a company may historically have sub-contracted much of its radar development and manufacture to companies in the SME category. However, as a consequence of mergers and acquisitions they may now have this capability in-house. This action has achieved a number of things including:

- Keeps another value adding activity within the organisation.
- Potentially it removes this resource from its competitors.
- It enhances the resource base for the firm and could, ultimately, result in new opportunities for the firm in the future.

There is a counter argument however, in that as these organisations grow, and the complexity of relationships and supply arrangements increase, there is potential for performance to be hindered through a lack of responsiveness, communication barriers and cultural differences.²⁰

Similarly, as mergers continue, each of the parties brings with them a supply network of SME's. However, it is unlikely that the prime contractor will want to maintain all of these suppliers even if only to remove areas of duplication. This trend is already apparent with a number of "primes" stating that they are looking to reduce the number of suppliers they deal with directly.²¹ One major European prime contractor has already stated that their supplier base of 400 in 1997 is to be cut to 25 by the year 2001. It is intended that these suppliers will provide the liaison with other SME's at lower levels in the supply chain. Some prime contractors are using techniques such as Supply Chain Relationships in Aerospace (SCRIA) to identify their future direct suppliers.²² Such an approach is consistent with the move to Smart Procurement. In order to achieve the goal of Faster, Cheaper, Better it will require the prime contractor to have a clear understanding of the capabilities of their suppliers and for more members of the supply

chain to be involved at an earlier stage in the development process. In this respect, there is an oversimplification of Smart Procurement. In many ways it ignores the structural complexity of the market – the implication being that it is only prime contractors who have to work within the ‘new’ strategies. Initially and naturally, the Smart Procurement Initiative was closely related to major equipment procurement projects, however the impact of Smart Procurement is becoming more widespread. The impact is not only upon major contractors, but also the various tiers of sub-contractors who provide them with supplies and services throughout the supply chain. Further complexity is added through the organisational and internal changes that are occurring within the Ministry of Defence for both uniformed staff and civil servants. Within the newly created Integrated Project Teams (IPT's) there is greater potential for contact with “empowered” personnel, whether uniformed or civilian. The effects of Smart Procurement now reach down to all aspects of defence acquisition and logistic support, for example, the increased use of outsourcing, contractor logistic support and the creation of the Non-Project Procurement Office, reflect the development of strategic purchasing and supply in the commercial sector. Although this will benefit those chosen 2nd tier suppliers it could present a major obstacle for those SME’s at lower levels in the supply chain.

The new shape of the industry

In effect, one can see a situation developing in the UK where the prime contractors and a selected number of 2nd tier suppliers will be able to put a hurdle in front of the SME’s lower down the supply chain. The situation outlined should be a serious concern for SME’s in the UK. However, it has even greater significance when one considers that many of the mergers and acquisitions are Europe wide and as such a

whole raft of new SME competitors are, in effect, entering the highly competitive UK market.

The developing shape of the industry is depicted in Figure 2 and shows quite clearly that a potential communication bottleneck is developing such that the prime contractors will work through a screen of new gatekeepers at the 2nd tier level. It follows that some current 2nd tier suppliers will also have to be prepared to work closely with companies that have traditionally been viewed as their direct competition within the 2nd tier. Equally, it will mean that many of the smaller businesses will have to evaluate their current relationships and networks to ensure that they are in the right place and have the necessary business connections in order to participate in future business.

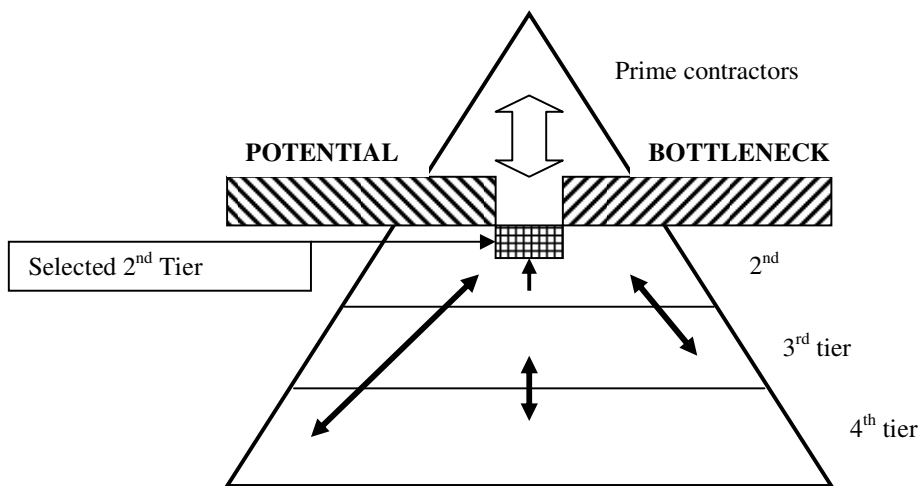


Figure 2. Potential future structure in the defence industry

In addition, because of the way that preceding initiatives have been crystallised within Smart Procurement (such as Frontline First and Competing for Quality etc.), notably the Private Finance Initiative/Public-Private Partnerships, and the move generally to improve public service procurement,²³ the defence environment is changing. It is not purely manufacturing, but increasingly service based, as logistic support

contractors and facilities management contractors enter the market in roles that were traditionally undertaken in-house (that is, either uniformed military or civil service).

Strategy and Industry Dynamics

The changing structure of the industry is having an impact on the operational dynamic of the market.

The key issue for the SME's is clarity of how they will fit into the new structure. Typically one would expect the medium sized enterprises to build these factors into their strategic thinking. The types of issues they might consider include,

- Scope for diversification (related or unrelated) into non-defence industry activity.
- Scope for product development to increase areas of involvement within the defence sector.
- Defence industry exit strategies.
- The need for strategic alliance / partnering agreements in order to maximise expertise and the opportunity to enter into new markets in the case of contractor logistic support and facilities management.

A major issue concerns the means by which any development is achieved, in some cases they might consider mergers, acquisitions or joint ventures with other medium sized enterprises (horizontal integration). The advantage of such an approach is that the firm can rapidly achieve scale benefits and bring together a range of skills and resources that makes them attractive to the prime contractor. A slower approach would involve purchasing a range of smaller firms, however this presents both benefits and risks. A potential benefit not to be underestimated is the option of being able to select a

wide range of complimentary skills from within a large pool of small firms. Increasingly the type of skills and technologies used in the supply of defence equipment is moving from traditional sources to more innovative types of technology. Similarly, relationships are moving from adversarial ones to those that are more mutually beneficial.²⁴ Although the growth strategy outlined suggests a degree of flexibility in terms of being able to select from a wide range of small firms, once purchases have been made the skills and technologies absorbed into the company may become sources of rigidity that hinder the firm in the longer term. This goes to the crux of the matter in respect of the Smart Procurement Initiative²⁵. There is considerable academic and practical evidence²⁶ that strategic purchasing and supply chain management is most effective when the buying organisation is able to work closely with a limited number of highly preferred suppliers. Smart Procurement reflects this but the Ministry of Defence cannot be classed as a purely commercial organisation as illustrated in the literature.²⁷ It is in fact a bureaucratic organisation that finds the entrepreneurial culture difficult to assimilate.²⁸

The key driver for medium sized enterprises is to position themselves within the pool of similar sized firms such that they are the first choice for the prime contractor. One would suspect that most medium sized enterprises have clear organisational structures in place and that strategic planning plays an important role in running the business. Thus one would hope that the implications of the structural changes in the industry are exercising the minds of many senior managers.

However, SME's face the same industry threats and in many cases they may well be in a worse position than the larger enterprises. Many of the small enterprises employ less than 10 staff and are run by the founder owner. Unfortunately, in many cases they

tend to operate with very short-term horizons and view the future on a contract by contract basis.

It may be that for many of the small enterprises the range of strategic options is limited, if for no other reason than they may not have access to financing in order to give them flexibility to manoeuvre. However, it is still imperative that these firms give full consideration to the options identified earlier. For example, if a firm cannot be the purchaser they may find salvation in being the seller. In other words their strategy might be to make themselves attractive to a medium sized enterprise or to another small enterprise either for sale or merger or even a joint venture / alliance.

In some ways this is already starting to happen with consortia forming throughout the United Kingdom (Northern Technologies, Hampshire Economic Partnership). However, this has tended to be on a regional basis and as such it might impose significant restrictions in terms of putting together the resources and skills required by the prime contractors. The technologies, skills and resources required to be successful in the defence/aerospace sector are unlikely to be bounded regionally. Indeed the forward thinking firms should be considering their options beyond the United Kingdom and looking Europe wide for their future partners. In Italy this process is already happening, firms involved in the defence and aerospace industry are working together on a business partner basis where the key criteria are the skills and competencies required in delivering the end product. Small firms have found that co-operation can provide a competitive advantage in the market.

This paper has thus far considered the defence and aerospace industry in structural terms that focus upon national and international contexts, however, there is an

additional dimension that must be considered within the industrial base itself. This complexity dimension has to be examined to give a better appreciation of the developing supply chains that will deliver effective performance.

In this respect, the Smart Procurement Initiative offers potential to SME's generally. The recognition of effective customer-supplier relationships, identified as relational competence, is a mechanism for improving performance.²⁹ This is not to suggest that it is not underpinned by competition. Rather, it is a more open relationship in which joint approaches to cost reduction are applied, and where gain sharing is the norm, rather than the exception.³⁰ For this to be effective, in a commercial environment, generally requires an understanding of the 'total cost of ownership' i.e. whole-life perspective to costing, measurements of performance, and benchmarking. Although inevitably, a key to success will be a need to change the culture to enable such applications to be introduced.³¹ A change in the shape and dynamic is appearing in the defence/aerospace environment. No longer merely manufacturing based, it is increasingly including service providers. Further 2nd tier suppliers are more involved in the process of selection of, and influence to, suppliers in the supply chain. The supply chain itself is being recognised, bringing potential benefits for lower level suppliers, whilst increasingly in the provision of services there is a likelihood that many will bypass the traditional prime contractor route, opening up opportunities for SME's.

Overall, this changing shape will impact upon the industry as a whole either in terms of the operational effectiveness of the Armed Forces or performance of aerospace prime contractors. If it improves performance then SME's may look forward to increased importance, if operational effectiveness is reduced then opportunities will diminish. Thus

there is a need to maintain balance in the light of the changing structure of the defence/ aerospace environment, as shown in Figure 3.

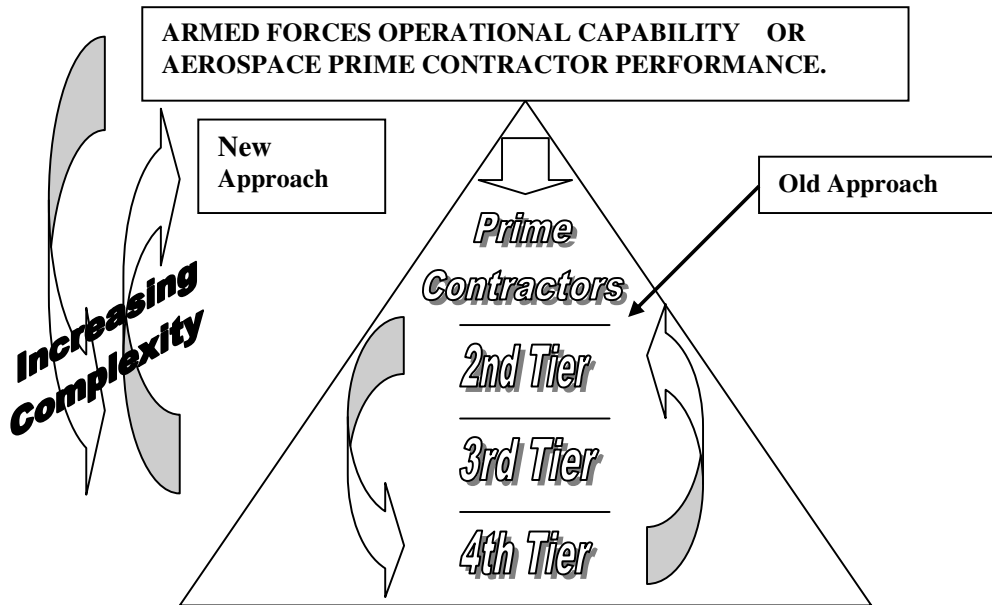


Figure 3. The increasing complexity in the new military-contractor relationships.

Conclusions

A wide range of factors are influencing the defence/aerospace industry as it works through the process of restructuring. Whilst most of the attention is being directed at the prime contractor level it must be recognised that the changes have major implications throughout the supply chain.

In essence SME's need to review their approach to strategy such that they are comfortable considering new paradigms to secure their future. A strong case can be

made for the SME's to consider their position in terms of skills and resources and identify ways that they can be bundled together in order to produce a competitive advantage. For those SME's that actually think seriously about strategy there is probably an understandable tendency to consider the issues in terms of products and markets, even large corporations have difficulty in thinking of strategy in terms of resources, skills and competencies. This acknowledges the supply chain as a means of gaining value from all layers involved in the chain. Smart Procurement offers further opportunity to leverage customer-supplier relationships within the chain, it also offers potential opportunity for those organisations in the chain to become more directly with the more traditional defence organisations.

Although the initial perception is that the restructuring will simplify the supply chain the paper highlights that the additional flexibility, inherent in structures such as the new IPT's, has scope to introduce further complexity. Such complexity can be detrimental to the aim of achieving balance in terms of Armed Forces Operational Capability.

Such approaches may represent major challenges for the average SME, however, failure to acknowledge the changes and identify strategic options and new ways of working may result in paying the ultimate price - business failure. In order to avert this outcome it is suggested that further research needs to be undertaken to improve our understanding of the industry dynamic for SME's.

So far in this paper some of the changes in industry structure have been identified and in particular they have been linked to the potential for barriers to develop within the supply chain.

Research is required to explore the role of supply chain management within the new (emerging) structure. In particular, given that the SME's will bear the brunt of this change, the research really needs to be viewed from the bottom up. This indicates that there is a need to redefine the boundaries of the supply chain.

Implications arise from this in respect of organisational culture of SME's, as well as the changing value system of the defence environment and the need to understand and utilise relational competence.

In analysing the supply chain it is clear that many of the SME's will need to adapt their approach to strategy in general and in particular their view of strategic option generation. Such a change process has relevance to many parties including:

- Players in the supply chain through to the highest levels.
- Stakeholders within the defence environment.
- SME's undergoing the change process.
- Academics observing this move to a new paradigm and reconciling this against our current understanding of the evolution of strategy within the small enterprise.

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