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Evolution of Purchasing Strategy in the Aerospace Industry

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Résumé

Problème: Le but de ce mémoire est d'analyser l'évolution de la stratégie d'approvisionnement de l'industrie aérospatiale et les facteurs qui ont une influence sur son évolution.

Objectif: Les responsables des achats des entreprises du secteur à formuler les stratégies les mieux adaptées pour lutter contre les menaces et les défis auxquels l'industrie est confrontée.

Structure: Ce mémoire est conçu à partir des informations secondaires et est divisé en trois chapitres. Le premier chapitre met en lumière l'importance de la stratégie d'achat, ainsi que ses rôles et fonctions qu'elle occupe dans une organisation. Le deuxième chapitre décrit l'industrie aérospatiale, ainsi que sa présence et son importance dans le monde. Ce chapitre approfondit l'importance de l'industrie aérospatiale ainsi que la relation qui unit l'industrie aérospatiale et la stratégie d'achat. Le dernier chapitre est une étude des facteurs qui ont une incidence sur les fonctions d'achat de l'industrie aérospatiale. Enfin, nous analysons la compétitivité du secteur en effectuant une analyse des cinq forces de Porter et utilisons les résultats pour formuler des recommandations pour les responsables des achats.

Constatations: L'analyse de l'industrie aérospatiale nous a permis de conclure que tous les facteurs indiqués dans l'étude insistent sur la nécessité de réduire les coûts. Dans la poursuite de cet objectif, les fabricants d`équipements d`origine (OEM) pressent les fournisseurs de réduire les prix, ce qui a un impact sur la qualité et les performances du fournisseur. Il est donc suggéré aux responsables des achats d'aligner leurs produits en fonction de leur importance et d'établir des collaborations stratégiques avec les fournisseurs.

Implication pratique: Le cadre présenté dans le document peut aider les gestionnaires à formuler des stratégies en fonction de l'importance du produit et peut également aider à choisir des relations appropriées avec les fournisseurs.

Importance: Cette étude aide non seulement à identifier les facteurs qui influencent l'évolution de la stratégie d'achat dans le secteur de l'aérospatiale, mais également l'importance de l'alignement de la stratégie d'achat avec la stratégie d'entreprise.

Limites de la recherche : Cette étude est basée sur une recherche secondaire où la littérature, les coupures de journaux, les rapports annuels des sociétés aérospatiales et aériennes et les rapports de l'industrie ont été utilisés pour identifier les changements

dans la stratégie d'achat et les facteurs qui l'influencent. En outre, cette étude se limite à un type d'industrie, celui de l'aérospatiale et plus particulièrement des constructeurs OEM. Cette étude pourrait aider les équipementiers de l'industrie automobile, l'industrie partageant certaines caractéristiques avec l'industrie aérospatiale, mais la pertinence pour d'autres industries est limitée.

Recherches futures : Des études à partir des données primaires pourraient démontrer les relations avec les facteurs identifiés comme ayant un impact sur la stratégie d'achat de l'industrie aérospatiale.

Abstract

Problem: The aim of the study is to understand the evolution of the purchasing strategy in the aerospace industry and the factors impacting its evolution.

Purpose: The understanding of the changes in the purchasing functions and factors that are leading to these changes will help purchasing managers to formulate strategies that are best suitable for the industry. This study serves the purpose of a snapshot of the industry and explains the strategies that are adopted by purchasing managers to brawl against the threats and challenges that are faced in the industry.

Structure: The study is based on secondary research method and is divided into three chapters. First chapter sheds the light on the importance of purchasing strategy and its roles and function in an organization. The second chapter describes the aerospace industry and its global presence and importance. It elaborates on the purchasing strategy adopted by OEMs and how it is evolving. The last chapter is a study of the factors that are impacting the purchasing functions of the aerospace industry. Lastly, we analyze the competitiveness of the industry by conducting Porter Five Force analysis and use the results to suggest appropriate strategies for purchasing managers.

Findings: The study and analysis of the aerospace industry brought us to the conclusion that all the factors indicated in the study are emphasizing the need for cost reduction. In pursuance to achieve this objective, the Original Equipment Manufacturers OEM are pressurizing suppliers to reduce price which is impacting the quality and performance of the supplier. It is therefore, suggested to the purchasing managers to align their products according to their importance and form strategic collaborations with suppliers.

Practical Implication: The framework introduced in the paper can help the managers to formulate strategies according to the significance of the product and can also assist in opting for suitable relationships with suppliers.

Significance: This study is significant because not only it helps to identify the factors that are impacting the evolution of the purchasing strategy in the aerospace industry, but it also assists in identifying the importance of the alignment of purchasing strategy with the corporate strategy of the firm.

Research Limitations: This study is based on secondary research where literature, newspaper clippings, annual reports of aerospace and airline companies and industry reports were used to identify the changes in the purchasing strategy and factors impacting

it. Also, this study is limited to one type of industry, aerospace and specifically OEMs. This study might help the OEMs of the automobile industry as the industry shares certain characteristics with aerospace industry but the relevance to other industries is minimal.

Future Research: It is recommended that the researchers could base a primary research to demonstrate the relations with the factors that are identified to be impacting the purchasing strategy of the aerospace industry.

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Acknowledgement

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List of Acronyms

AFP	Automated Fiber Placements
ALAFCO	Aviation Lease AND Finance Company
BRIC	Brazil, Russia, India and China
CAD	Computer Aided Designing
CAM	Computer Aided Manufacturing
COMAC	Commercial Aircraft Corporation of China
CRA	Canada Revenue Agency
CUI	Canadian Unmanned Incorporation
EU	European Union
GE	General Electrics
IATA	International Air Transport Association
MBD	Model Based Designing
MRO	Manufacturing Repair and Overhauls
OEM	Original Equipment Manufacturer
OPEC	Organization of the Petroleum Exporting Countries
PFS	Partnering for Success
SADI	Strategic and Defense Initiative
SR&ED	Scientific Research and Experimental Development
STIQ	Sous Traitance Industrielle Quebec

UAV	Unmanned Aerial Vehicle
UAC	United Airline Corporation
UK	United Kingdom
USA	United States of America
UTC	United Technologies Corporation

1. Introduction

The aerospace industry is one of the most robust industries in the world. It has shown remarkable resilience against economic and social factors since its inception. The industry operates with long production lead times and an extended gap between investment and return. Aerospace manufacturers invest millions of dollars into research and production before seeing the final aircraft and realizing the success or failure of their investment. While we can all appreciate the complex production processes that produce state of the art commercial, regional and military aircrafts, the key role of effective purchasing across a number of tiers and countries is often overlooked.

Over the years, purchasing has emerged as a critical function in the aerospace industry, with a significant impact on overall business performance. Scholars have highlighted the importance of the purchasing function and its alignment with corporate strategy as a factor that can improve business performance and lead it towards success (Ellram & Carr, 1994). Purchasing strategy has gained importance due to many factors in the aerospace industry, including globalization, rigid competition, the constant need for innovation and a growing need to identify the right suppliers that can best address the needs of customers. It is therefore important to understand the prerequisites for a successful purchasing strategy.

Purchasing strategy can be defined as a set of decisions taken by the purchasing professionals during the process of buying, keeping in consideration the dynamic changes in the internal and external environment (Terpend et al., 2011). As the aerospace industry has undergone many changes due to globalization, the evolution of purchasing strategy and its importance is evident. The OEMs have increasingly taken the role of aircraft assemblers and are outsourcing the production of most parts and components. This means that OEMs are producing less and relying more on purchased products from suppliers to assemble aircrafts. For the OEM, purchasing is thus one of the most important functions of their business, as their final product could not reach market without purchasing the component parts.

There are hundreds of manufacturing companies that are operating all over the world under different capacities and supplying different kinds of parts and components to build an aircraft. These parts and components are then assembled by a few large firms, who are driving the wheels of the industry. A change in their purchasing strategy, can change the future of hundreds of companies that are providing OEMs parts and components for aircrafts. In this study, we will focus on understanding the changes in the sourcing strategy of the largest players in this supply chain, the OEMs, and its impact on suppliers, in the

aerospace industry. It will also help us in identifying the sourcing strategies that are being practiced in the industry.

Researchers have previously pointed out that the aerospace industry has uniquely pivoted between the two extremes of adopting vertical integration and extensive outsourcing strategies. An in-depth study of the purchasing strategy in the aerospace industry can help us in identifying the impact of these changes on buyer-supplier relationships when the strategies are used interchangeably and how it has impacted the evolution of these relationships.

The aerospace industry works on a hierarchical structure. The OEMs are at the top of the structure, followed by different tiers of suppliers that are all working closely with each other. This makes aerospace an extremely integrated industry. These integrations, spread globally, are prone to be impacted by the changes in internal and external environment. In order to combat the effects of this changing environment, purchasing managers alter the nature of the strategic relationship between them and their suppliers. Thus, the complex structure of the aerospace industry and the heavy reliance of OEMs on purchasing, provides an ideal context to understand how purchasing managers are formulating their relations based on changes in the sourcing strategies and dynamic pressures from the internal and external environment.

Purpose of the Study

As mentioned previously, purchasing strategy has emerged as an extremely critical function of the aerospace industry. It has been observed that in pursuance to reduce cost and maximize revenues, the Original Equipment Manufacturers (OEMs) have been experimenting with their sourcing strategy and their relationships with suppliers to formulate a strategy that could work in mutual interests. As sourcing, supplier selection and relationship management are components of the purchasing strategy, this study aims to explore purchasing strategy in the aerospace industry and to identify the factors that are molding it.

In pursuance to achieve our goal, information from secondary sources was collected to understand how purchasing strategy is practically applied in the aerospace industry. This thesis serves as a guide for purchasing managers of OEMs, providing them insight into how purchasing strategy is being impacted by the external environment and how they can use their internal capabilities to gain competitive advantage for the firm.

The main objective of the study is to understand the evolution of purchasing strategy and how it is implemented today in the aerospace industry. To achieve this objective, we shed

light on how purchasing managers of Original Equipment Manufacturers are formulating strategies to combat the threats and exploit opportunities that are posed by their internal and external environment.

Research Questions and Structure

In order to comprehend the evolution of purchasing strategy in the aerospace industry, this study focuses on four aspects:

Q-1. What is purchasing strategy?

Q-2. How is purchasing strategy evolving in the global aerospace industry?

Q-3. What are the factors that are triggering changes in the purchasing strategy of the aerospace industry?

Q-4 How should purchasing managers of OEMs formulate a strategy that best serves the corporate interest of the firm?

Over the next 3 chapters, we conduct a review of the academic literature and use secondary resources to answer the first three questions.

The first chapter of the study is based on identifying the critical role and functions of purchasing strategy like selecting a sourcing strategy, formulating supplier selection criteria, selecting suppliers and managing relationships with them based on the importance of the product. In addition to this, we demonstrate the link between purchasing strategy and business performance as well as the importance of their alignment.

The second chapter starts with an introduction to the aerospace industry, followed by a discussion of industrial structure and its importance in the global market. Following this discussion we provide an overview of the changes in the purchasing strategies used in the aerospace industry.

The third chapter of the study focuses on identifying the factors that are leading to changes in the aerospace industry. This study includes eight factors: globalization, emerging markets, technological advancements, the prime customer of the aerospace industry, oil price fluctuation, exchange rate fluctuations, environmental considerations and the institutions, are impacting purchasing strategy in the aerospace industry.

Lastly, the study entails an analysis of the external and internal environment of the industry to determine the competitiveness of the aerospace industry, followed by a cross

case analysis of the three largest companies in the aerospace industry. Van Weele (2005), suggest that Kraljic matrix when used with the Porter Five Force, can help in understanding the needs of the buyers and suppliers in a skillful way and therefore can help to devise a strategy that serves the requisites of both parties. In pursuance of Van Weele's suggestion, we use the Porter five force analysis and Kraljic matrix to formulate a model that can help purchasing managers in formulating strategies.

2. Chapter 1: Purchasing Strategy

In order to discuss the evolution of purchasing strategy in the Aerospace Industry, it is important to begin by understanding purchasing strategy itself. We use existing literature to fulfill this task in this chapter. The first three subsections discuss the various definitions found in the literature for purchasing strategy, its role and scope and the use of the Kraljic Matrix to formulate purchasing strategy respectively. Section 2.2 focuses on strategic sourcing and the important decisions that fall under its ambit. Section 2.3 contains a discussion on effective supplier selection and management of the buyer supplier relationship. The last section contains a discussion on the link between successful purchasing strategy and improved business performance.

2.1.1. Definition

There is myriad research on what purchasing strategy is and most researchers define purchasing strategy in a similar way.

Definition of Purchasing Strategy	Author
Purchasing strategy is a decision-making process where an organization recognizes a need of product or service and to fulfill that need it chooses a supplier in the market	(Webster & Wind, 1972)
A concept that was developed to seek the attention of practitioners for the strategic implication of the buying activities in manufacturing companies	(Bonaccorsi & Paliwoda, 1990)
A specific action taken in order to gain control to achieve specific objectives like management's decision of establishing long term relations with its supplier is part of purchasing strategy.	(Carr & Smeltzer, 1997)
A comprehensible pattern of decisions implemented during buying products which are made by several people involved at different functions and levels of management	(Moses & Ahlstrom, 2009)
Legally sanctioned transaction purposefully initiated to acquire goods, services or tradable commodities from a source. The buyer identifies the needs of the end user, evaluate what is required to fulfill that need, lay down criteria for the supplier and select the supplier that best matches the need of the customer.	(Monczka, B.Handfield, Giuniperro, & Patterson, 2011)
Purchasing Strategy is the patterns of decisions taken by purchasing professionals during the process of buying and in consideration of internal and external constraints that could affect the business environment.	(Terpend, Krause, & Dooley, 2011)

Table 1: Definition of purchasing strategy

Though all definitions are accurate when it comes to describing purchasing strategy, some of these definitions fail to address all the functions that are included in purchasing strategy.

The definition by Webster and Wind (1972) states that purchasing strategy is a decision making process where an organization recognizes a need of product or service and to fulfill that need it selects a supplier in the market. The definition explains the two major elements of purchasing strategy: identification of the need and selection of a supplier to satisfy it.

Monczka et al. (2011) goes a step further from Webster and Winds definition and stresses on importance of the purchasing strategy. They describe purchasing strategy as a systematic process where the buyer identifies the needs of the end user, evaluate what is required to fulfill that need, lay down criteria for the supplier and select the supplier that best matches the need of the customer. Once the buyer identifies a suitable supplier, the buyer has to develop a mechanism for placing an order, certify timely payments for the supplier, ensure that the final product is satisfying customer needs and strive for continuous improvement. In this entire process of purchasing the managers have to ensure that both internal and external users are satisfied with the process (Monczka, B.Handfield, Giuniperro, & Patterson, 2011).

For this thesis, we will use the definition of purchasing strategy provided by Monczka et al. (2011) as it includes all functions performed by purchasing departments in modern organizations. Once we have established the definition of purchasing strategy, it is vital to comprehend its role and function.

2.1.2. The role and scope of purchasing

Arjan Van Weele (2010), describes the functions of purchasing strategy by dividing the purchasing into two parts: tactical function and order function. The tactical function is related to all the activities that could help in sourcing like identifying the internal customer, determining their specifications, selecting the supplier that best matches the specifications and then laying a contract that matches the need of both buyer and supplier. The order function, on the other hand, is related to post contract transactional activities like placing the order, evaluation of the order and follow up the supplier (Weele, 2010).

Monczka et al. (2011), however divides purchasing strategy in three dimensions unlike Arjan Van Weele (2010). The three categories introduced in the paper are overall goals, tactical functions and strategic goals. All three categories are further divided into tasks.

Overall goals include managing the purchasing process, development of the sourcing strategy, ensuring supply continuity and keeping stakeholders aligned with the strategy. The tactical function includes laying supplier selection criteria, future forecast of demands, supplier selection and measurement of the performance of the supplier. Lastly, the strategic goals include supplier management, ensuring prompt payments, demand management and continuous improvement in performance. Firms have to manage all three functions in alignment with their corporate strategy in order to create harmony among their activities.

It is important for firms to recognize purchasing as a strategic function. Coulson-Thomas (2008) divides companies between winners and losers depending on their approach towards purchasing and their ability of recognizing its importance. Winners consider purchasing strategy as a contributing factor in achieving competitive advantage. They recognize the importance of purchasing functions so they tailor their activities to ensure that the purchasing strategy works in harmony with corporate objectives. They involve suppliers in the research and development of the product, try to reduce cost, invest in innovation and build healthy relations with their suppliers. Losers, on the other hand consider it to be an administrative activity. They follow the dogma, that purchasing is nothing more than finding the right source, at the right time at lowest possible cost.

Purchasing strategy has a substantial impact on two functions of an organization; sales and costs and eventually profits. Purchasing strategy is increasingly being considered a strategic weapon for the successful performance of a firm (Cousins P, 2005). Some research suggests that purchasing strategy acts as the backbone of a business, as it could help an organization in gaining competitive advantage in a highly competitive market. When deciding the purchasing strategy of the organization, it is crucial to develop strategies according to the strategic importance of the product. This rising trend of recognizing the strategic importance of the purchasing function is allowing firms to substantially reduce transaction costs, create competitive advantage and achieve ever greater economies of scale.

2.1.3. Kraljic Matrix

One of the models that help identify the contextual factors affecting the selection and implementation of a purchasing strategy has been proposed by Kraljic (1983), which specifically suggests that “purchasing must become supply management”. To delineate the choices affecting purchasing, Kraljic (1983) introduces a matrix in the first part of the article that identifies four stages: purchasing management, materials management, sourcing management and supply management. Wherever the need or relevance for purchasing is high, supply management becomes extremely relevant. In the second part

of the article, Kraljic (1983) argues for a four-stage approach towards the development of a supply strategy beginning from the classification of all products that a firm has purchased in order to quantify their impact on profit as well as associated supply risks.

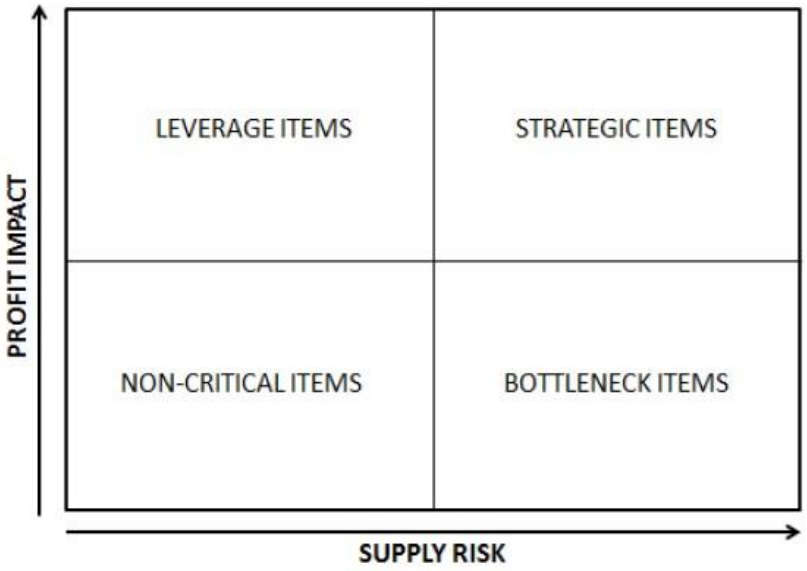

Figure 1: Kraljic Model. Adopted from Kraljic (1983)

He divides all products under four categories: strategic, leverage, non-critical and bottleneck products. Each of the four categories has different supply risk and impact on profitability. The first category discussed in the matrix is 'non-critical items' which include products that are available at low cost. The products that come under this category have lower supply risk and relatively little impact on the overall profitability of the business. As the products are readily available in the market, there is no supply threat, and the firm can exploit the opportunity of having the desired price for the products.

The second category is 'bottleneck items', which include products that might not have a significant impact on the profitability or performance of the firm but a discrepancy in their supply can create difficulties for the firm. These products are difficult to locate in the market and can usually be acquired from only one supplier. Therefore, when discussing the supplier-buyer bargaining power, suppliers dominate the market with a medium level of interdependency. For bottleneck items, buyers should keep extra stock to avoid the high risk of supply discrepancy and should actively search market for more suppliers.

'Leverage items' are the third category in the Kraljic Matrix. The items in this category are mostly standard items, with many suppliers in the market that are producing similar products. Therefore, there is low supply risk. These items represent a high percentage of buyer's profit, and the buyer dominates the market. However, the interdependency is

moderate because of which buyers usually select suppliers by formulating a specific selection criteria and form umbrella agreements.

The last and most essential category is that of ‘strategic items’. Strategic items hold significance for the buyer and can have a considerable impact on the overall performance of the business. The supply risk, on the other hand, is considerably high. Increased lead times or discrepancy in the delivery of strategic items can impact the overall profitability of the firm. The buyer-supplier bargaining power is balanced here yet the interdependency is high. In case of strategic items, long-term relations and strategic collaborations can help in formation of well knitted relations with the suppliers.

The Kraljic matrix is significant to analyze the purchasing portfolio of a firm as it helps in defining priorities for the purchasing department. It helps in differentiating critical items from noncritical which assists in making outsourcing decisions. However, it is hard to measure the impact on profitability or the supply risk on each of the four categories discussed in the matrix.

Van Weele (2005), suggests that the Kraljic matrix, when combined with the Porter Five Forces Model can help in picturing the complete interaction of buyer and supplier in the industry. He suggests that when these two analysis models are combined, they assist in understanding and matching the buyer and supplier strategy. He names the combination of two as ‘Dutch Windmill’. Cousin et al. (2008), supports the stance of Van Weele (2005) and suggests that the Five Force Model helps to understand the internal and external environment swaying the industry, its competitiveness, the substitute power, the entry barriers and bargaining power of both supplier and buyer.

2.2. Strategic Sourcing

In pursuance to understand the sourcing process, it is important to start by discussing the concept of sourcing. Sourcing can be defined as a function that helps to fulfill recognized needs of end customers by selecting affordable and reliable suppliers and managing relations with them (Scott et al., 2011).

The sourcing process involves more than just selecting suppliers. It is more strategic than how it’s seen. It involves maintaining relations with the current suppliers, changing the supplier selection criteria according to the changing needs, developing the existing suppliers according to the changes, looking for potential new suppliers that could help achieve corporate objectives and how to align the purchasing objectives and strategy with corporate goals (Baily et al., 2005). Having an efficient and effective sourcing process offers numerous benefits for the companies for instance it helps in reducing cycle time,

improved cash flow, cost reduction, improved quality of the product, development of technology and improved end customer service (Scott et al., 2011).

Gottfredson et al (2005) encapsulate that a sequence of success in technology, geopolitics and macroeconomic factors has unbolted world markets. The open market without national boundaries has made business more portable allowing companies to access a bigger pool of suppliers and demand. After differentiating the importance of the product strategically, companies can source the production to suppliers who offer reduced cost and help to achieve efficiency. Strategic sourcing therefore, is a systematic approach incorporating a long-term outlook towards procurement trends.

A crucial disclaimer that must be sanctioned here is that the term ‘strategic sourcing’ has attracted different terminologies, and Chang (2006) has interchanged it with ‘outsourcing’ and ‘global sourcing’. Such actions of interchanging terminology are acceptable insofar as it does not digress from the ‘strategic’ aspect of the term ‘strategic sourcing’, which reflects a long-term approach in how procurement is done. This is inherently different from the aspect of global sourcing and outsourcing that is intended to replenish immediate requirements on an ad hoc basis.

Strategic sourcing has several underlying elements, two of which are geographical distribution of suppliers and their numbers available to sustain the requisite supply. Often ignored are elements such as economies of scope, which is relevant to companies manufacturing several products, routine for aerospace companies such as Bombardier and Boeing. The discussion of these underlying elements inevitably opens up discussion of single and multiple sourcing, as well as global and domestic sourcing.

In the following subsections we will briefly introduce some of the important sourcing decisions faced by modern firms. These questions include the choice between global or domestic sourcing, outsourcing or vertical integration and multiple or single sourcing.

2.2.1. Global & Domestic Sourcing

When sourcing, it is essential to evaluate suppliers in both local and foreign markets. Over the last few decades, most companies have shifted from domestic sourcing to global sourcing due to its comparative benefits.

Pol et al., (2004), explains global sourcing as a systematic process of sourcing product or services from an international market across geopolitical boundaries. He explains that global sourcing is a result of globalization which he further divides in two aspects;

operations in an international marketplace: procurement policy to access foreign sources and strategic orientation: globalization as the direction towards purchasing activity.

He makes an interesting case by applying a marketing framework, keeping in considerations the purchasing strategy of the firm. The result of this experiment was introduction of four distinct activities traditional procurement: sourcing in home market; international purchasing: operational activities that aim to satisfy the procurement requirements with aim at reducing cost; strategic oriented procurement: sourcing strategically in the home market and global sourcing: sourcing strategically in international market.

The literature on ‘international’ and ‘global’ sourcing can be a source of confusion and contradictions, which makes it imperative to deliver a clarification on them. Trent et al. (2003) define ‘international purchasing’ as a stop-gap measure adopted to satisfy immediate requirements upon a company, where ‘global sourcing’ refers to a long-term approach in determining supply chain strategy of the company, inclusive of integration, coordination and supply consolidation.

If this understanding is to be accepted, the definition which Trent et al. (2003) have rendered for ‘international’ sourcing does not conform to the critical element of strategic sourcing, which is long-termed, planned approach to purchasing. Therefore, the decision left to undertake for a company would be on the grounds of ‘global sourcing’ and ‘domestic sourcing.’

There are several advantages that could be exploited with the implication of global sourcing especially when it comes to cost saving. Herbig et al. (1996), highlight some of the potential benefits that a firm may achieve by applying global sourcing. Advantages like controlling cost by operating in international markets, access and catering the demand of foreign market, improved quality of product by sharing knowledge with foreign suppliers, developing and using superior technology for greater outcome and reduction in tariff and custom barriers.

Laster et al. (1997), suggest that in order for global sourcing to be effective companies need to create a supply base and have physical presence in the foreign country. They identify many companies that are turning from domestic to global souring because of the inability of local suppliers to reduce cost or improve technology. However, adoption of global sourcing can be risky for the firms due to unavailability and discrepancies of information regarding the supply base, currency fluctuation risks, change in tariff policies and logistic and intermediary costs.

Jin (2004) further elaborates that the decision to opt global or domestic sourcing would predominantly include the consideration of 'costs,' which is further complicated by technological advantages, skilled labor supplies and the time it takes to delivery (Jin, 2004). He acknowledges the benefits offered by global sourcing but also emphasizes on the uncertainties of going global. Bozarth et al. (1998) add to these factors by noting the contribution of offset agreements, currency mechanics, local trade barriers, access to technology and quality of inputs to the equation of deciding to go global or remaining local. Given the number of determining variables in deciding between global and domestic sourcing, it is difficult to conclusively assert what strategy would be the most suitable for a company to lodge its efforts behind.

2.2.2. Multiple Sourcing vs single sourcing

The determinant factor between single and multiple sourcing is efficiency and competition. This may also be dependent upon the geographical distribution of the suppliers. It is vital to illustrate different sourcing options that a buyer may peruse to ensure successful relations with the suppliers.

Single sourcing is when a business is involved with one supplier for a particular product and service. Sourcing operations from one supplier offers several advantages, including singularity in volume being produced and delivered, as opposed to several products being sourced from multiple locations and then being synchronized for function later. This is an expedient method to set up economies of scale in production, allowing for a company to deliver large-scale ambitious production targets in conservative estimations of time (Burke et al., 2007).

Moreover, sourcing from one supplier directly implies lower risk of disruption in supply chain operations, which reduces production costs significantly (Burke et al. 2007). Burke et al (2007) also carefully point out that in the case of single sourcing, the supplier and the manufacturer are in a better position to form strategic collaborations and subsequently gain multiple product design and production advantages.

On the flipside, multiple sourcing is when a buyer does business with several suppliers in the market and enjoys the benefit of best price and quality by comparing suppliers with each other (Yu et al., 2009). Multiple sourcing not only allows better assurance of timely delivery of the products but also allows flexibility in the volume of the product required. Multiple sourcing also involves reducing buyer dependency on the supplier, strategically weakening supplier power. Burke et al (2007) suggests that wherever a company has vested interests in diversification and deals with smaller capacity in terms of product deliveries, it becomes strategically advantageous for it to employ multiple sourcing.

This raises the question of what determines the best sourcing strategy between multiple and single sourcing. Grözinger (2015) borrows from the observations and expounds on them to conclude that “price sensitive managers have a tendency for multiple sourcing strategies while purchasers that focus (be it out of personal preference or product requirements) on supplier reliability in terms of delivery, reliability of the supplier’s products, and technical support quality are more likely to be single source.”. Both strategies have their relative benefits and disadvantages. The actual strategy selected should depend on both the products being bought and the firm’s strategic imperatives.

2.2.3. Outsourcing

Outsourcing is one of the most crucial sourcing decisions for modern firms. It is defined as a method of obtaining goods and services from outside sources by forming a contract (Tsay, 2014). He expands upon outsourcing from a comparative point of view; and introduce two terms – outsourcing and offshoring. He appears to abridge the difference of understanding between the two by referring outsourcing as to “who” will do the work that is being delegated, while offshoring refers as to “where” it will be done. Therefore, one can also easily proclaim that a company can, in one swoop, outsource as well as offshore a project.

He further elaborates on the advantages of outsourcing by arguing that outsourcing helps buyers concentrate on their core business and provide them an access to other markets. Outsourcing also allows buyers financial flexibility by turning their fixed cost to variable. Effective outsourcing can lead to a flexible knowledge sharing environment that helps to increase product quality and achieve efficiencies.

Tsay (2014) conversely, points out the constraints of outsourcing as well, prioritizing communication and coordination as the bane of successful outsourcing operations. If a project has been outsourced overseas, time delays in coordination, shipping and information sharing can be a hassle to deal and comply with. Moreover, if a company consistently outsources a particular task, in the long run, this operation or arrangement can become expensive and the knowledge for it may also become difficult to acquire. Service providers, to whom such operations are outsourced, act in their own interest, and sometimes that interest may align elsewhere. In a situation such as this, outsourcing can damage relations and halt processes, which can incur financial loss at a large scale. For this purpose, supplier relations are essential and they have been discussed in this paper as well.

2.2.4. Vertical integration

In contrast to outsourcing, firms can choose to produce a greater number of parts in house. This is called vertical integration and often involves buying firms that were previously supplying key components. The companies in aerospace industry though were initially based on the vertical integration strategy, the strategy was changed from vertical integration to outsourcing with the course of time (Bogaisky, 2018). However, parts of the aerospace industry have seen a growing trend towards vertical integration again in recent years.

Oliver Williamson (Williamson, 1985) argues – under the ambit of transactional cost economics – that if it is not easy for companies to switch trading partners, integration should be seen as a viable solution. Renegotiation of outsourcing contracts can be a taxing process – costing time, effort and financial resources with a considerable risk of failure. If such transactions are complicated, contractual incompetence can creep in, threatening the Kafka-esque cycle of legal action and bureaucratic mishandling of a private issue.

The evidence from the defense sector also appears to be one of integration. Over the years, cooperation has intensified as new technologies make the old ones obsolete. Moreover, there has been an explosion in development and operational systems that improve an aircraft's performance, and this 'explosion' can be credited to various research groups and engineering companies that aircraft manufacturers want to take on board for a competitive product. Schmitt (2000) has argued that this experience of cooperation has revealed a new, and perhaps more efficient path towards consolidation of processes and financial risk, which is called integration.

Joint ventures are one of the pioneering efforts in integration, where such ventures occupy the space and privilege of an entire corporation concerning their financial management and product development. An example of one such joint venture is the "Joint Strike Fighter" program, where technology-sharing and manufacturing of jets is related to processes occurring in several nations who have a financial as well as an operational interest in the project. While contractual complexities may still exist in such an arrangement, the element of risk-sharing means that there is a substantial incentive for all the interested parties to resolve issues.

Another benefit of vertical integration for a company involved in the development of both civil and military technology is to compensate for the inadequacy or underperformance of another. This allows the company to build and sustain its portfolio in one of the two categories – civil and defense – even when times are difficult. The integration of industrial

functions that occurs, as a result of the joint venture, can bring innovation as many engineering concepts and innovations can be applied to the civil sector if developed through military-specific research, and vice versa.

Boeing is one such company that enjoys a successful integration of military and civil technology, with the company manufacturing the air superiority fighter F-15 Strike Eagle apart from its civil aerospace product suite. It has also been discussed in the section about OEMs that even the OEMs are seeking a vertical integration platform with their tier service providers to incorporate risk sharing in order to promote efficiency in the entire process. At this rate, vertical integration seems to be a logical choice for aerospace companies to gravitate towards because it retains most of the benefits of outsourcing and improves on operation efficiency.

The above discussion effectively demonstrates the importance of sourcing, the sourcing process and the need to identify it as a strategic decision. Choices such as multiple or single sourcing, outsourcing or vertical integration and global or local sourcing have the potential to shape the strategic direction of a firm. Neither of these decisions have a correct choice in all circumstances, rather firms nor need their purchasing managers to carefully decide which choice works best for the specific product, market and customer.

Sourcing is one variable in the purchasing strategy apparatus. Having demonstrated the importance of sourcing as a strategic function, we will focus on recognition of the right suppliers. The next two sections discuss the importance of successful supplier selection and ways to manage the buyer-supplier relationship effectively.

2.3. Supplier selection

Supplier characteristics and capabilities have a huge impact on buyer performance. In a highly competitive environment, companies prefer suppliers that are capable of sustaining a requisite supply of the desired quality product at relatively minimum price in the market. Price and quality are not the only criteria taken in consideration for nominating suppliers, as both the internal and external environment of the firm exerts a sizable influence on this process of decision making. Globalization has had an important effect in increasing the importance of supplier selection for firms. Trent et al. (2010) showed that most European firms did not believe in the significance of supplier selection for overall performance. However, this perception changed as they learned from global competitors that placed much greater emphasis on supplier selection and considered it crucial for their success.

Damian Beil (2011), describes the supplier selection process as a way through which buyers can identify, evaluate and hire a supplier to perform specific tasks. He argues that

the supplier selection process is extremely crucial for the firm not only because of its monetary impact but also because it directly impacts the quality of the product. He emphasizes on the importance of screening suppliers before contracting and suggests a list of factors, including reference and financial check of supplier, its ability and capacity to expand and meet changing requirements of buyer, to be thoroughly reviewed.

Several papers have been published to suggest supplier selection criteria, to the buyers. Khaled et al. (2011), suggests a model that could be used while making the decision of selecting the supplier. The model is divided in seven steps starting from defining the evaluation criteria, weighing each evaluation category, identification and weighing of subcategories, scoring each category, direct supplier evaluation, review of evaluation and selection of supplier and review of supplier's performance.

Qi et al. (2015), conducted a research on supplier competition and its impact on firm's sourcing strategy taking in consideration the impact of whole sale price and reliability of the supplier. The research suggests that reliability is often considered to be more important than the whole sale price in supplier competition. It further suggests that an ideal strategy for the suppliers would be to maintain high reliability and low whole sale prices if there are multiple suppliers that are catering the buyer.

Supplier selection consists of numerous complications including qualitative and quantitative factors. Consequently, it is essential to make certain trade-offs between tangible and intangible circumstances. According to Ghodsypour et al. (1998) capacity constraints are one of the crucial complications typically encountered by buyers in the process of selecting suppliers. A prospective buyer needs to rigorously analyze their demands before they select the right suppliers. Increasing interest in supplier-buyer partnerships are driving the attention of buyers to design appropriate supplier selection criteria that would supplement their needs and long-term business strategy. A well-designed supplier selection criterion that ties with the buyer's business strategy would not only result in much welcomed cost reductions but also in improved relationships with suppliers.

Tracey et al. (2001) confirm that supplier selection criteria play a vital role in the success of buyer-supplier relations. Suppliers that are selected on quality, pricing, reliable delivery and performance of products are able to satisfy their customers more effectively on the basis of four determinants (product quality, competitive pricing, reliable deliveries and firm performance). They also emphasize on the importance of involving suppliers in product development leading to innovative suggestions for continuous improvement in the product. Flexibility in the supply base is also an important indicator when selecting

suppliers. It illustrates how quickly a supplier will be able to respond to changes in order volume, customization of the product (Handfield et al., 2005)

It can be concluded that as purchasing has taken a more central role in firm performance the importance of selecting the right suppliers has also increased. Supplier selection has a great impact on the financial wellbeing of the firm, the quality of its products and its strategic capabilities. Over time we can also observe a shift in both the criteria for supplier selection and the recognition of its importance. Firms are often preferring quality and reliability over cost minimization (Tracey et al., 2001). Total quality management not only includes quality products but also includes service quality requirements and efficient purchasing. Supplier selection criteria should be broadly defined, considering different tradeoffs and be specific to different products. Effective supplier quality practice can lead to major advantages like world-class supply-based performance. However, achieving this involves careful consideration of the tradeoffs between cost and quality as well as an honest analysis of the specific demands of the buyers.

2.3.1. Supplier Relationship Management

Globalization and increased competition have impacted supplier management and enhanced its importance. Companies believe that a healthy long-term relation between a buyer and supplier can lead to successful business. Therefore, companies are reviewing their relations with their suppliers and sorting suppliers on the basis of their importance in the supply chain. Suppliers are being short listed according to the strategic importance of the product they supply to the buyer. Prahinski et al., test the buyer supplier communication process and its impact on supplier's performance based on three strategies: formality, indirect influence strategy and feedback. They reached the conclusion that if the supplier is providing a non-critical product, the buyer could eliminate them if the cost of operations is high. On the other hand, buyers should focus on building long-term relations with critical suppliers (Prahinski et al, 2004).

Scott et al. (2011), have introduced supplier relation management as a process that seeks a proactive way to manage and strengthen buyer-supplier relationships. They contend that adoption of such relationship management techniques could be beneficial for the development and success of both supplier and the buyer. They further elaborate the benefits of the supplier relations management approach by claiming that it helps to break the functional mindset and barriers while helping both buyers and suppliers to exchange ideas and assets. This process can lead to greater innovation and clarity in the supply chain.

In the quest to identify the prospects of relations between buyer and suppliers Cousin et al (2008), formulated a model known as Strategic Focused Outcome Model. The prime use of this model is to assist in determining the relationship strategy that a company could use when dealing with the suppliers. The model measures the impact of the two variables: the strategic focus and business outcome. These two variables are further divided into parts to observe the type of relationship that could be formed under different strategic objectives. The strategic focus covers two different strategies: cost and differentiation, which are Porter's generic strategies and the business outcome covers short-term and long-term objectives. Based on these two models and their subdivisions, the model offers four outcomes.

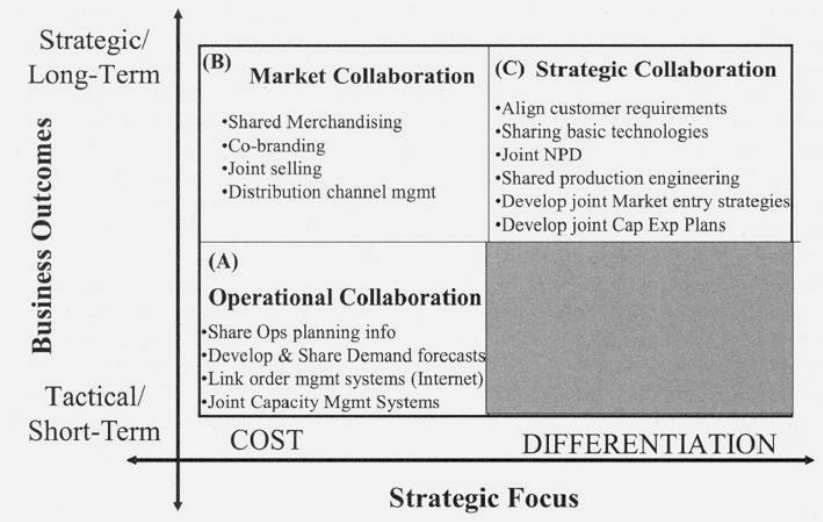

Figure 2: The Strategic Focused Outcome Model (Cousins P., 2005)

The Market and operational collaborations focus on controlling cost for both long-term and short-term business objectives. The main focus of the supplier and buyer is to achieve economies of scale and therefore both parties are involved in forming collaborations with the motive of reducing cost. Operational collaborations are relations that are short-term and limited, such as sharing operational information and demand forecasts as well as joining capacity management systems. Market collaboration is a form of long-term relationship and includes more collaborative activities like co-branding, joint selling and shared merchandising. The main focus of the firm is reducing cost, for which they form long-term relationships with their suppliers. By forming long-term relations, the company avoids the chances of knowledge spillover (Cousins P., 2005).

In order to further elaborate on his stance on the supplier-buyer relationships, Cousin et al. (2008) developed another model known as Strategic Relationship Positioning Model. He argues that the relationships between buyer and supplier should be formed following

the position of the firms. Therefore, the matrix is developed around two factors: the level of dependency and level of certainty. The level of dependence represents the level of reliability shared by both the buyers and suppliers whereas the level of certainty is an indicator of the level of risk of success or failure involved in the formation of the relationship between supplier and buyer. Considering the two factors, he proposes four different types of relationships that could be formed between the supplier and buyer depending on the power they share over each other.

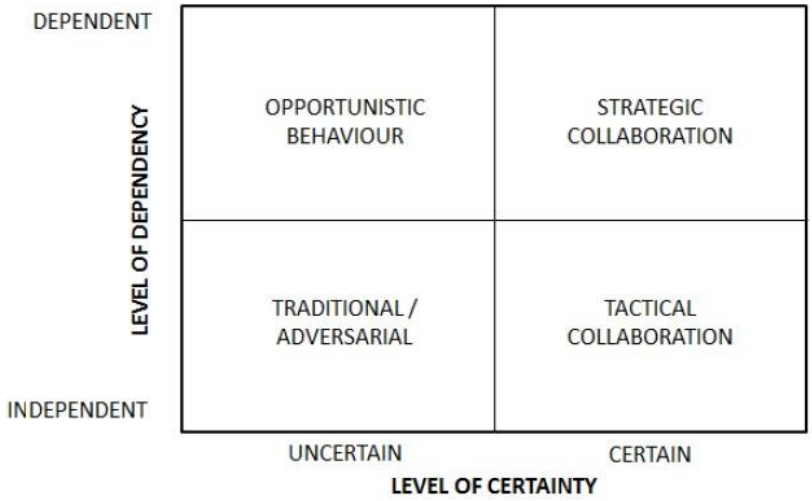

Figure 3: The Strategic Relationship Positioning Model (Cousin et al. 2008)

The first relationship shown in the matrix is the traditional relation which includes both a low level of certainty and dependency. Both suppliers and buyers try to benefit from each other, but they are not interdependent. In case of any form of disagreements, the relation could be void, and the buyer or supplier can seek other parties for their supply or sale. According to Kraljic matrix, traditional relationships are shared with the suppliers of noncritical items where operational collaborations are practiced to achieve the required business outcome.

Opportunistic Behavior, on the other hand, has a high level of dependency but low level of certainty. Opportunistic behavior is practiced when one of the two: buyer or supplier enjoys dominance over the other and therefore can distort the course of relation. The dominant player will be in relation till the required business outcome is achieved and can end the relationship in case of the undesired outcome. Opportunistic behavior relation is mostly observed in leverage products and it leads to market collaborations.

The third dimension in the matrix is tactical collaboration where the level of certainty is high but the level of dependence is low. Both suppliers and buyers might form short-term collaborations in order to achieve certain business outcome. According to the Kraljic

matrix mostly bottleneck items fall in this category with a strategic focus. The last dimension is strategic collaboration. The dependency level and level of certainty are high in strategic collaboration which is formed in order to achieve strategic goals. Both the buyer and suppliers share knowledge and work collaboratively for mutual benefits. According to Kraljic matrix strategic collaborations are formed for strategic items. Altogether, this matrix helps in identifying which kind of relationships are beneficial for the firms under certain circumstances. This helps managers select the best strategy that could help them to achieve their required goals (Cousins et al, 2008).

Janda and Seshadri (2001) suggest that when dealing with technical products, as is often the case in the aerospace industry, close relations with suppliers are always beneficial. They emphasized the importance of cooperative negotiation, claiming that collaborative negotiation can boost overall performance as there will be knowledge sharing and transparency on both ends. Both the buyer and the supplier will have terms of their interests in the contract administered between them, motivating them to strive mutually for success. In the long run, these collaborations between suppliers and buyers enable trust, teamwork and commitment ensuring a supply of quality products with reduced cost and furtherance of beneficial innovation (Handfield et al., 2005).

Supplier Relationship Management is increasingly important for modern firms. It is also important for firms to consider these relationships with respect to the products being procured and the supply market situation. The same relationship strategies cannot be used for all suppliers and products. Firms can manage these relationships based on their goals and performance or based on their relative dependency on each other. Successful management of buyer-supplier relationships can significantly improve business performance not only in terms of cost cutting but also for the development of more innovative products.

2.4. Purchasing Strategy and Business Performance

Over and above the decisions regarding outsourcing or vertical integration, single or multiple sourcing and supplier relationship management; it is crucial to understand that purchasing strategy cannot be effective if it is not aligned with the corporate objectives of the firm. González-Benito (2007), argues that it is essential for managers to integrate purchasing functions into the overall business strategic planning processes to ensure that the functional objects are aligned with the overall strategy of the business. He suggests that the goal should be to achieve congruence between business goals and purchasing objectives of the firm.

Ellram et al. (1994), studied the impact of purchasing and its growing importance in the structuring of corporate strategy. They introduce three distinct sorts of purchasing strategies in their paper. The first is the specific strategies exercised by the purchasing functions. The specific strategy focuses on planning and managing the necessary activities required for the development of a product. Here the primary objective of the purchasing manager is to provide what is required by the firm.

The second kind of purchasing strategies are the ones that define the role of purchasing in supporting the activities and strategies of the firm as a whole. This purchasing strategy focuses explicitly on matching functional objectives with corporate objectives. For instance, if the firm decides to pursue a cost-differentiation strategy, the purchasing manager will seek a supplier that could provide the desired products at the lowest possible cost.

The last stream focuses on the importance of the purchasing functions and considers it pivotal for driving the strategy of the firm. The idea behind this stream is that the company aligns its corporate strategy according to their purchasing need. Though all the three strategies can be differentiated based on the role of purchasing, what is common among the three strategies is the emphasis on the alignment of purchasing and corporate strategy.

Carr et al (1997), argues that in order to include purchasing in the strategic objectives of the firm, the purchasing strategy has to be recognized as a strategic function. They argue that when purchasing behavior follows a defined purchasing process, it is known as strategic purchasing which includes actions like analysis of the external and internal environment for strategy formation and implementation of strategy. They further elaborate the notion of strategic purchasing by drawing a link between corporate strategy and functional strategy.

The corporate strategy of the firm is the overall scope and direction of the organization whereas the functional strategy of the firm is concerned with integrating functional activities and linking it with the corporate strategy. In order for strategic purchasing to exist, the strategies at corporate and functional level should be consistent. Therefore, compliance between corporate and functional level is important in order to achieve the overall objectives of the firm.

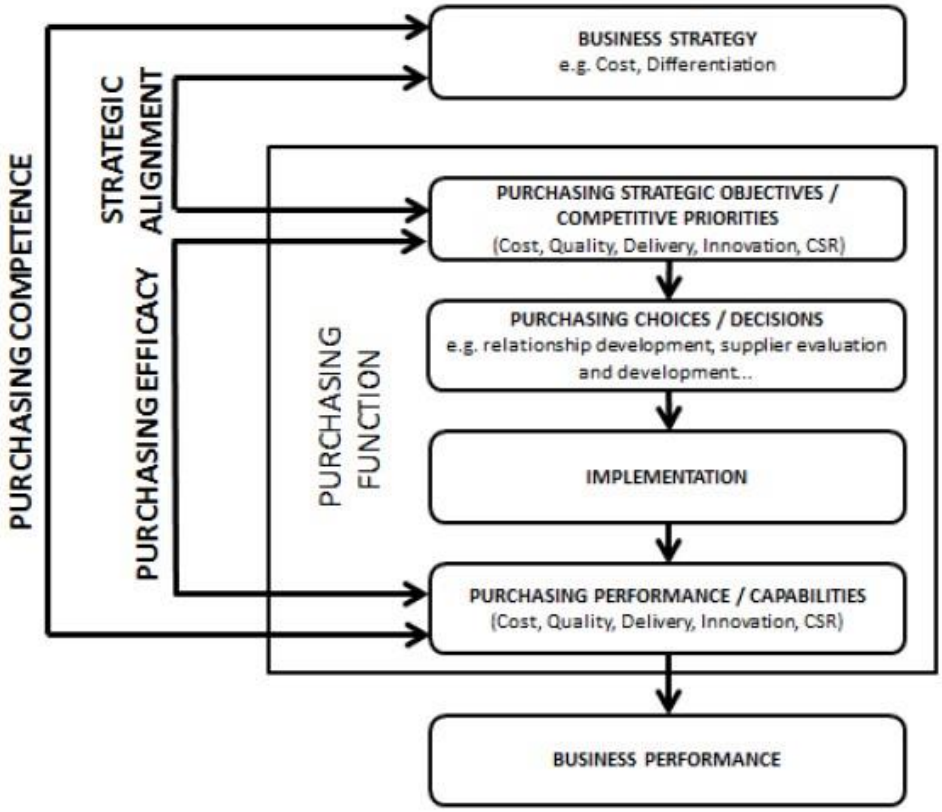

Figure 4: Illustration of the concept of Purchasing Competence (González-Benito, 2007).

In order to study the relation between purchasing strategies and the corporate strategy of the firm González-Benito (2007), links the strategy of the firm with purchasing performance. The study emphasizes the significance of the alignment of business strategy with purchasing strategy in pursuance to improve business performance. He discusses that if the strategies are aligned, then all the decisions that are taken by the purchasing department comply with the overall objectives of the firm.

2.5. Conclusion

In this chapter we have answered the question of what is purchasing strategy. We have provided an introduction to the concept of purchasing strategy, the most widely used method for its analysis, key concepts and importance. Purchasing strategy, while nominally concerned with reducing costs, contains the potential to create a distinct competitive advantage for firms if recognized as a strategic function. The key decisions that form part of the sourcing strategy can have a major impact on the future of a firm. In this chapter we identified the outsourcing versus vertical integration decision, single versus multiple sourcing decision and the local versus global sourcing decisions as some examples of important decisions in strategic sourcing. Each of these choices is well suited to certain scenarios.

We can conclude from our discussion that there is no single guide towards effective and successful purchasing strategy that is applicable for all products and scenarios. Effective strategy relies on taking into consideration the specific mix of product, market, suppliers and business goals for the buying firm. We have also highlighted the importance of selecting the right supplier selection criteria and the impact it can have on successful business performance as well as the importance of effective management of the buyer-supplier relationship. Finally, we show that any purchasing strategy will fail if it is not in alignment with the overall business strategy of the firm.

Once we have established the role and functions of purchasing and its importance in achieving corporate objectives, we will now focus on the application of this knowledge to understand the purchasing strategy in the aerospace industry.

3. Chapter 2: The Aerospace Industry

In this chapter we will narrow down our discussion towards the aerospace industry in order to ascertain how purchasing strategy is evolving in the global aerospace industry. The industry can be divided between three major sectors: commercial/civil, defense and space. In order to sketch an accurate representation of the aerospace industry, it is imperative to explore civil and military aspects of the industry separately. The first three sections of this chapter focus on the sectors of the global aerospace industry, its structure and the state of the global market. Finally, section 3.4 focuses on the evolution of purchasing strategy in the aerospace industry.

3.1. Sectors

Commercial aerospace has surged with rising demand, and according to Embraer's Market Outlook (2017), the demand for passenger/civil travel is expected to increase over the next decade. Similarly, military expenditures continue to increase, as nations scramble to develop new technologies in order to subdue their threats. The global aerospace and defense (A&D) industry is experiencing steady economic growth, and according to Deloitte (2018), the entire industry is expected to continue strengthening with industry revenues forecast to increase by as much as 4.1 percent, which is an improvement from the forecast predicted by Deloitte (2017) in the past year. Due to numerous differences it is important to discuss the commercial and defense sectors of the aerospace industry separately.

3.1.1. Commercial Sector

The aerospace industry is relatively complicated, both in terms of technology as well as the involvement of stakeholders in management due to the sensitive nature of the functions performed. However, there are several usual variables that impact the commercial outlook including fuel prices, technology access, access to skilled labor and more (Deloitte, 2018).

The commercial aircraft sector, as per the reports from Deloitte (2018), is expected to grow as much as 4.8 percent in revenue, where manufacturers like Airbus and Boeing predict to produce more aircrafts this year than in the previous few years. This can be attributed to several factors, such as lower fuel prices making air travel an accessible avenue for many, as well as the fact that travel demand has consistently shown signs of growth of around 5.1 percent in the last ten years.

According to Deloitte (2018), this growth has been primarily driven by the customers from the Asia-Pacific region, which agrees with the fact that countries in this region, specifically China and India, are experiencing surging economic growth. The same report also predicts that this trend will not be halted: “passenger traffic is expected to grow at an annual growth rate of 4.7 percent, contributing to increased aircraft production.” There is overwhelming data to support this assertion, provided that the passenger travel demand has astonishingly grown seven times from 1981 to 2017.

Another indicator for increased commercial aircraft demand and production comes from a report by KPMG International (2017), stating that “the expected rise in air travel globally suggests that airlines will replace their fleet at a rate of between 2.5 percent and 3 percent per year with new growth adding about 5 percent of capacity for the next few years”. This report also argues that lower energy prices globally have contributed to an increased available budget for countries, translating to more purchasing power for the end consumer who now can spend more money on air travel.

Currently, the market share statistics of the aerospace industry indicate a duopolistic hold of Airbus, a European enterprise, alongside its main rival and competitor Boeing, which is a U.S. based manufacturer. These two companies produce commercial jets to cater an airline’s large aircraft requirements as well as middle tier aircraft in terms of carrying capacity. Over 65 percent of jets used by airlines worldwide consist of a fleet from Airbus and Boeing (Statista, 2018). Coming in third place is Canada’s Bombardier, while Brazil’s Embraer takes a close fourth place.

To understand this hierarchy, further segmentation would be required, dependent on product type. Airbus and Boeing, while being the leading manufacturers in the commercial aerospace sector, are at the helm because they manufacture large to mid-sized planes that can provide for an airline with high volume requirements. Embraer and Bombardier, on the other hand, carry the market segment that requires smaller commercial jets. That is why these two companies have a growing rapporteur in manufacturing smaller ‘private’ or ‘business’ jets.

3.1.2. Defense Sector

Variables in the defense aerospace sector are intangible like the volatility of international relations, heightened security tensions and an ever-growing focus on conducting an effective war on terrorism. Countries are increasingly spending large sums on military technology and arsenal up gradation. It has been corroborated by Tian et al. (2018) that there had been an increase in global military expenditure in 2017 of 1.1 percent when compared with 2016 making it a total of $1739 billion in 2017.

According to Deloitte (2018), the global defense sector revenues, in step with defense budget allocations, is set to see an increase of about 3.6 percent in the year 2018. Moreover, the report forecasts that the current figure of $1.7 trillion will eventually cross $2 trillion by the end of 2022, at an annual growth rate of about 3 percent. As mentioned, there are several reasons for this alarming growth. The foremost is the cold arms race occurring amongst several nations across the world, most notably the U.S., China, and Russia, who are continually developing fifth-generation aircraft technologies to claim the rights of operating the absolute air superiority fighter.

The United States already has two, with F-22 Raptor and F-35, while China has also begun fielding its stealth variants that are titled J-20 Chengdu and J-31. Russia, meanwhile, has also developed a stealth aircraft called Su-57, which is yet to enter active service. According to Deloitte (2018), the volatile situations in the Middle East, as well as in the South China Sea, alongside the ever-present tensions on the Korean peninsula, there is enough impetus for nations to invest in defense technology spending. In 2016, as per Deloitte (2018), “India, China, and Russia’s military expenditure rose by 8.5 percent, 5.9 percent, and 5.4 percent year-on-year, respectively”.

Other industrial manufacturers are competing in an extremely competitive environment, and these include SAAB from Sweden and PAC from Pakistan. SAAB and PAC both have developed a fourth-generation light multirole fighter jet called the Gripen and JF-17 respectively. PAC’s JF-17 is a low-priced product aimed at countries with low military budgets who want to upgrade and replace aging fighting jets, while Gripen is aimed at customers with a sizeable military budget looking to upgrade their warfare capabilities.

In the next section we will discuss the industrial structure of the aerospace industry before moving onto discussing the global market.

3.2. The Structure of the Industry

The aerospace industry is structured in several tiers, all arranged in a hierarchy where one tier is ultimately aiding the functions or tasks of another. These tiers consist of different levels of suppliers that supply parts to the tier above, ending with the OEMs on top, who design and assemble the final aircrafts. Linking these tiers requires successful management of large and complex supply chains, with requirements being precisely indicated between the different tiers.

As mentioned above, the Aerospace Industry is divided into a tier structure which comprises of Original Equipment Manufacturers (OEM), followed by tier 1, tier 2 and tier 3 suppliers. The highest in this hierarchy lies tier 1, with tier 3 at the bottom as depicted

in Figure 5. This hierarchy is determined by the level of complexity required to perform a designated function.

The Tier Structure of Aerospace Industry

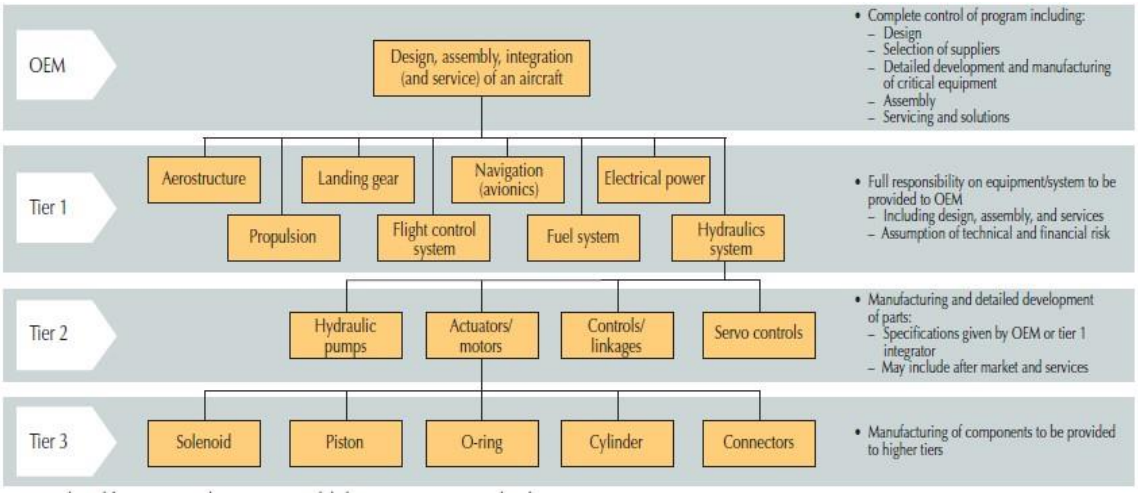

Figure 5: The Tier Structure of Aerospace Industry. Extracted from Globalization in Aerospace and Defense, PricewaterhouseCoopers, January 2008. Adapted from Aerospace Review Mandated by the Government of Canada Volume 1 "Beyond the Horizon: Canada's Interest and Future in Aerospace Industry", November 2012

All in all, these tiers make different components of an airplane that are supplied to an Original Equipment Manufacturer (OEM), which is responsible for assembling all the supplied components. Be it the military or civil sector, the OEMs are the ones with complete control of the program from conceptualization until the assembly and delivery of the product. They occupy a critical role in maintaining this fluid industrial process, contributing most usefully in terms of innovation around which the entire industry can robustly operate. OEMs are also responsible for repair work for their designated product. There are few OEMs operating in the market including Boeing, Airbus and Bombardier that are currently holding the top positions in the market.

Tier 1 suppliers supply parts and components directly to the OEMs and are thus the next most significant part of this structure. They manufacture, integrate and assemble parts like landing gears, propulsions, fuel systems, electric powers, and other vital parts. There are hundreds of Tier 1 suppliers operating in the market including Lockheed Martin, General Dynamics, and United Technologies.

Tier 2 suppliers work according to the requirements of either OEMs directly or tier 1 suppliers. These suppliers are either involved in manufacturing, and detailed development of components like hydraulic pumps and/or are providing after-sale services.

Tier 3 suppliers manufacture smaller components and parts of the aircraft. These suppliers are involved in the manufacturing of pistons, cylinders, O –rings and other parts of the aircraft. Some of the Tier 3 suppliers are working for Tier 2, Tier 1 or even directly with OEMs.

The collaborations between the customers of the OEMs –which are airline companies– are dependent upon market clout. OEMs have less market presence or financial clout as compared to the primary customers, and this can potentially undermine an OEM's revenue targets because of the customer's advantage in bargaining. (Mocenco, 2015). The stakeholders (like aircraft manufacturing companies like Lockheed Martin) seek to work in risk-sharing projects where OEMs are given the opportunity to collaboratively develop the final product. This ensures a stability of business opportunity for the OEM and may also lead to future business opportunities.

The OEMs in turn use the same tactic with the tiers that serve them. The rationale behind such collaborative efforts is moving production towards a system of 'integrators of value' (Blokland et al, 2010). This sheds the bulk of the risk of the OEMs to Tier 1, 2 and 3 manufacturers, who are now exclusively involved and collaborating to develop avionics, composite materials, wings, fuselage and more. This process is also termed as 'value leveraging', where the OEM reduces the supply complexity and makes the supply chain process 'leaner'. Some countries have specialized different roles in the manufacturing involved in the aerospace industry, while others have successfully consolidated all these functions to become self-reliant and leaders in industry.

3.3. The Global Market

Measuring the strength of the aerospace industry in different countries can be a challenge as it can be measured on a number of different criteria. The size of corporations, global market presence or the cumulative exports of the aerospace industry in a country, all provide a measure of its relative size. It can be assumed that using export data in particular should provide a good indication of both the size of OEM's and their suppliers as well the global integration of the local industry.

Daniel Workman (2017) provides a comprehensive ranking based on exports made by each country in the aerospace sector and accounts for the total exports made in 2017 globally to be around $326.4 billion. This figure shows an increase in export over four

years since 2013, nearly rising by 3.4%. However, the total value of aerospace exports has declined by 1.9% from 2016 to 2017. An interesting feature to note here is the contribution and presence of Original Equipment Manufacturers (OEMs) in the export equation, allowing countries like Ireland to be ranked in the top 10 for aerospace exports. The table below provides the ranking:

Countries	Aerospace Export 2017	Percentage of Total World Exports
United States	$170.84 billion	40.2%
France	$67.19 billion	15.8%
Germany	$54.43 billion	12.8%
United Kingdom:	$27.48 billion	6.5%
Canada	$12.63 billion	3%
Ireland	$8.98 billion	2.1%
Singapore	$8.59 billion	2%
Spain	$8.46 billion	2%
Italy	$5.99 billion	1.4%
Japan	$5.47 billion	1.3%
Brazil	$5.21 billion	1.2%
China	$4.82 billion	1.1%

Table 2: Countries that exported the highest dollar value worth of aerospace products in 2017 (Workman, 2017). The values are in CAD.

A look at this table affirms that this ranking by no means accurately depicts the size of the aerospace industry present in the countries mentioned above. China, for instance, is beginning to develop a robust aerospace industry and already has made sizable gains in the defense sector with the production of highly specialized aircrafts such as J-20, making it the second country in the world to produce a stealth aircraft fighter. However, export figures for 2017 show Ireland outperforming China by several places. Several factors such as government policy, secrecy, and exportability of programs, as well as the presence and interactions of OEMs with foreign customers, can explain this fact. Another factor that could explain this discrepancy, or perhaps accommodate a greater understanding of the ranking, is the conditions of the local and international airlines industry. This is a subtle distinction that must be made: the aerospace industry and the airline industry are intrinsically linked but can be distinguished as the airline industry is just one subsidiary of the civil aerospace industry.

The Civil and Defense Aerospace Sectors faced a growth in the annual revenue in 2017 with a 2.7 percent increase from $868.52 billion in 2016 to $892.34 billion in 2017. This

growth was mainly observed due to an increase in the defense sector of the industry. The growth in the defense sector was mainly due to an increase in government budget allotted for defense and security purpose. In contrast to the defense sector, commercial/civil sector growth was passive.

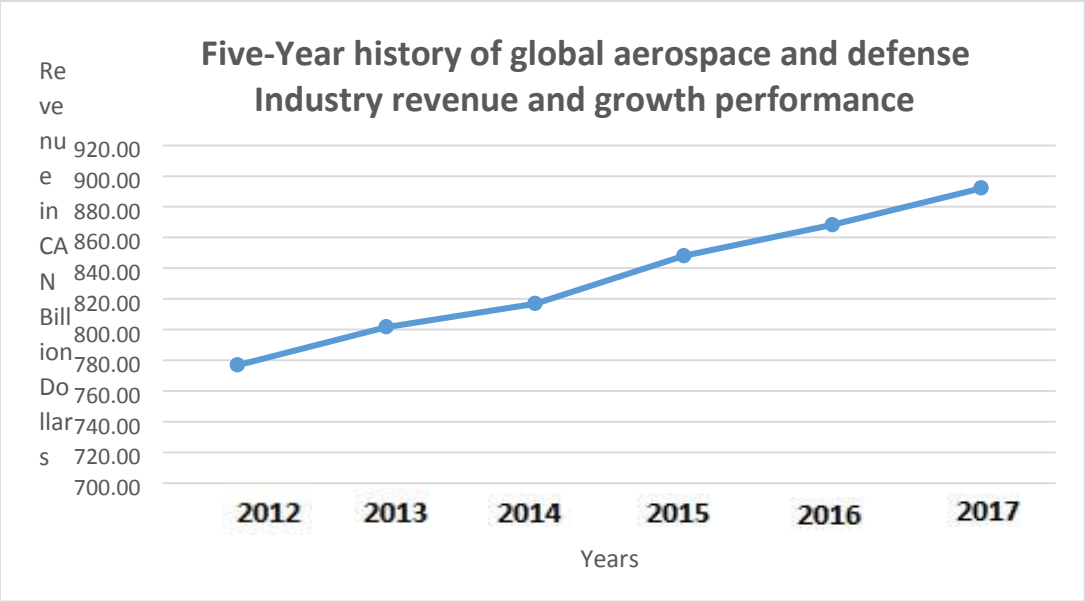

Figure 6: Five-year history of global aerospace and defense industry revenue and growth performance. The data was retrieved from Deloitte (2018).

Figure 6 represents the annual revenue of the global Aerospace and Defense Industry. If we see the growth of the industry from 2012 to 2017, we can observe that revenue has been increasing throughout these years. The percentage of increase does vary but the pattern has been similar. From 2012 to 2017 there has been an increase of 14.84% in the revenue of the industry.

However, in the aerospace industry, external factors (political scenarios, geographical developments, and others) have the potency to reshape and drastically impact operations and management. In order to moderate the volatility of external environment, anchor firms assume prominence as a viable solution which explains the geographical clustering in aerospace.

Research done by Jorge Niosi and Majlinda Zhegu (2005), suggests that clustering and sales are held by opposing forces. The aspects that tend to concentrate the industry in a particular geographical region are referred to as centripetal forces, while aspects that push firms away are referred to as centrifugal forces. They suggest that clusters are formed due to the presence of big companies in a geographical region. Cluster formation

starts when OEM or one/two Tier 1 firms start their operation in a region and attract small part and component suppliers and act as anchors. However, when the big firms tend to source internationally, the material exchange within the cluster tends to diminish. They also highlight the fact that the aerospace industry displays strong international connections due to its industrial characteristics. Such connections and international strategy may result in knowledge spill over. Knowledge spillover is interchange of ideas amid by individuals and it occurs when the recipient firm exploits the knowledge that was developed by another firm (Niosi et al. 2005).This is one of the reasons that despite of regional concentrations new markets have emerged offering innovative manufacturing capabilities in the aerospace industry.

3.4. Purchasing Strategy and Aerospace Industry

In the past decade, the transformation of business environment can be observed shifting towards being more globalized and integrated. This has led to intense competitive pressures from around the globe, enforcing companies to restructure their strategies, focusing on manufacturing quality and achieving economies of scale. Currently the aerospace industry, has experienced hasty changes with appearance of emerging markets, leading to high intensity of competitive pressures. In order to sustain competitive positions in a highly competitive environment, firms are required to plan their purchasing activities strategically and focus on continuous investments in innovation to develop new and high-value products (Gottfredson et al, 2005).

One of the major trends has been a repeated interchanging of outsourcing and vertical integrations strategies by OEMs. Eventually the change in the sourcing strategy impacts the supplier selections criteria and the relations that are shared with the existing suppliers. These changes lead to the remodeling of the entire purchasing strategy for the OEMs.

There are many factors that make purchasing in the aerospace industry unique. First, are the unusually long life cycles of aerospace products. Aircrafts can remain in service for longer periods of time which makes them long-term assets for several airlines. Even after expiry of their passenger-carrier functions, they are repurposed as cargo-carrying planes. This places the aerospace industry on a pedestal concerning purchasing strategies and also becomes its distinguishing factor (Mundt, 2003). Secondly, the industry relies heavily on new innovations. This requires extensive investments in research which often require multi-firm partnerships and strong institutional support from governments. The extended production cycle for new aircrafts further cements long term relationships between buyers and suppliers.

Also, the OEMs require parts and components in small batches, as they want to avoid the cost of inventory and storage. Therefore, OEMs are always in search of suppliers that can produce according to their required orders, hold inventory and deliver them on time. So, the sourcing strategies employed in this industry are invariably distinct (Mundt, 2003).

As has been previously opined in the Embraer's Market Outlook (2017), there is an expected growth rate for air travel in the years to come, which presents a challenge for the aerospace industry as there are few significant suppliers that could address the growing need. Also, the increasing growth identifies the need for large-sized aircraft for certain routes, such as Airbus' A380.

This is just one of the considerations that affect the purchasing strategy for aerospace manufacturers. Therefore, companies need to make smart purchasing decisions with regards to what companies are buying has been increasing in complexity, importance and size. Gottfredson et al. (2005) takes a step ahead to proclaim that not only is the ownership of capabilities important but also a company's ability to practice control and make the most of vital capabilities.

In the next subsections we will highlight some of the ways in which purchasing strategy has been evolving in the aerospace industry.

3.4.1. Interchanging Outsourcing and Vertical Integration

For almost the first four decades of the initiation of the aerospace industry, OEMs were performing all the tasks, from conceptualizing to designing, manufacturing and assembling the aircrafts themselves. Purchasing was never considered to be a strategic function of the company. The OEMs were insourcing as they were using their resources to research, design and conceptualize the product, purchase raw material, manufacture and later assemble the product. In other words, OEMs were vertically integrated. However, with the increasing complexity of their operations, vertical integration became more difficult and reduced overall efficiency. Slowly, companies started looking for alternatives that could help them reduce their costs and stay competitive in the market.

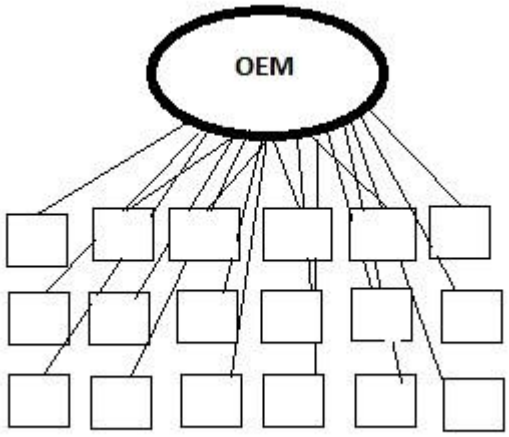

Figure 7: An illustration of the projected way of sourcing for OEM in the traditional method of sourcing. Adapted from: (Michaels, 2017).

In 1990's McDonnell Douglas American aerospace manufacturers and defense operators, now merged with Boeing, introduced the concept of outsourcing in the aerospace industry. Outsourcing is contracting activities to other operators in the industry that were previously performed by the firm. Besides, facing an extreme reaction from the labor union, Douglas believed that in order to sustain their position in the market and grow further, it was essential to seek ways to control costs and increase efficiencies and outsourcing was a solution (Michaels, 2017).

Outsourcing was a solution to many issues of the manufacturers operating in the industry. It allowed them to lower their costs and access the pool of skilled workers not just domestically but around the globe. By outsourcing their non-core activities, the manufacturers were able to focus on their core strength and turn them into a competitive advantage. Outsourcing also gave them an opportunity to grow and expand as they were able to reach the global market and address global demand. It also helped them to develop relations with the people operating in the same industry and gave them an opportunity to understand the dynamic needs of their customers for new and improved products (Fayer, 2016)

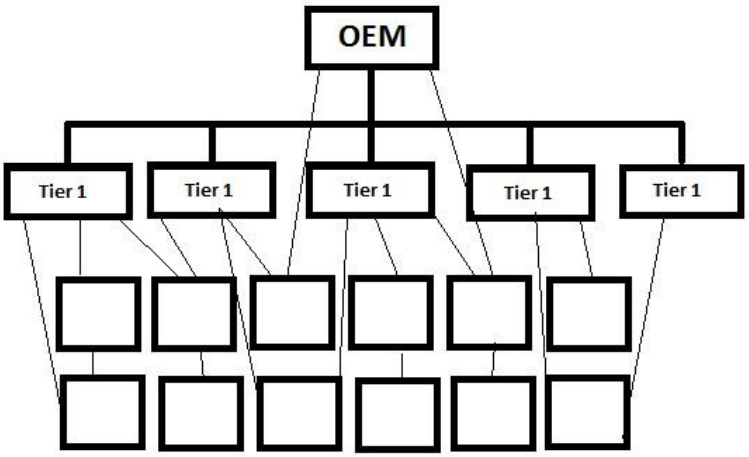

Figure 8: An illustration of the projected way of sourcing for OEM in the Tier1 Approach of sourcing. Adopted from: (Michaels, 2017).

In the 2000's an advanced approach was introduced by Bombardier that defined a new supply chain model known as "Tier 1" (Michaels, 2017). Prior to Tier 1 approach OEMs were working with many suppliers directly that were providing raw materials, bolts, metallic sheets and other components that are essential for the manufacturing of the aircraft.

The purpose of the Tier 1 approach was to reduce cost, share risk, increase profitability and to remodel the supply chain. Tier 1 approach offered a solution to the OEMs' problem by allowing them to have partners that could assist them by sharing the cost and responsibilities from research to production and then after sales services. In order to experiment the Tier 1 approach, Bombardier found 10 to 12 partners that would be involved in the operations of manufacturing the aircraft. They were not only sharing huge workloads but were involving their partners in system design. This experiment of sharing responsibilities turned out to be positive for Bombardier as 60% of the aircraft cost was funded by the suppliers involved in manufacturing (Michaels, 2017).

With the success of the Tier 1 approach, many OEMs started to follow it including Embraer, Airbus, and Boeing. Considering the opportunities that OEMs could exploit, companies outsourced the manufacturing of aircraft parts to suppliers. Suppliers were sent detailed information about the requirements of the products along with a sample and were expected to deliver the product in respective time and at a minimum possible price. The initial focus of global outsourcing was to reduce the cost of production and improve operational capabilities (McKinsey, 2008).

The success of the experiment also marked a change in the relations between OEMs and their suppliers. The Tier 1 approach redefined the selection criteria for suppliers and they

became a valuable part of the production process. They were involved in the production process from the conceptualization of the product to further research and then its development. Their input was considered valuable and taken into consideration at every level of the product's life cycle. The OEM was interested in building long-term relations with suppliers and help them grow and develop by investing in them. Emerging markets were presenting an excellent opportunity for the OEMs to build relations with new suppliers and help them grow as they could have access to cheap labor and low-cost resources.

While outsourcing provided a number of benefits it also raised some new concerns. Companies that were adopting outsourcing as part of their operations were concerned about the potential risks they had to incur. Firstly, as they were outsourcing their products to the domestic and international suppliers, they were scared of knowledge sharing. They were concerned about the leakage of complex information of their operations to smaller operators in the market which could result in exploitation of the OEMs at the hands of suppliers as well as the risk that these suppliers could turn out to be future competitors. Secondly, they were concerned about being dependent on subcontractors. The OEMs knew the importance of quality and timely production in the aircraft industry and if subcontractors were to manufacture parts, they would be dependent on them for the quality of the product and its timely delivery. Lastly, there were new responsibilities and costs for the OEMs as they had to coordinate and communicate with the manufacturers. They were still spending millions of dollars on networking with the suppliers and monitoring them (Mike, 2010).

Though the OEMs expected Tier 1 approach to stay, it was not long when the OEMs were hit with the downside of this approach. The Tier 1 approach was not a great success for Boeing and Airbus, leading to extreme losses during production of Boeing 787 and Airbus A380, which relied heavily on Tier 1 approach. The companies faced both delivery and quality issues in the production of the aircrafts. OEM realized that besides outsourcing and developing aircraft with tier 1 suppliers, they were still the ones bearing more risk and enjoying fewer profits than what they had initially expected. OEMs were also incurring much increased costs related to coordinating the supply chain and suffering from late deliveries.

As OEMs were not able to achieve their goals, with the adoption of Tier 1 approach, they started customizing it to meet their objectives. Where Bombardier and Embraer stayed loyal to Tier 1 approach, Airbus and Boeing took a step ahead to reinvent the supply chain model. This transition from Tier 1 approach to a new supply chain model is acknowledged as Post Tier 1 Approach. In this era, OEMs are more entailed towards adopting vertical

integration and are interested in restructuring the responsibilities of the suppliers they work with.

The OEMs expect that the vertical integration can help them in regaining the control over the manufacturing and can also assist in increasing profits. The idea of vertical integration seems more feasible with the introduction of disruptive technologies which includes robotic manufacturing, additive printing and digital manufacturing. OEMs can capture the margins in the markets by investing in these technologies which have plummeted the role of labor in manufacturing. Now that OEMs are aware, that they can produce through insourcing they are interested in working with more suppliers and reconstructing their relations with Tier 1 suppliers.

OEMs are emphasizing on the Tier 1 supplier to develop capabilities that could assist in producing complex systems. They want Tier 1 supplier to simplify their product design and produce complete modules. Suppliers that have the capability to match the need of the OEMs will stay in the supply chain and the ones that are unable to match the needs of OEMs will be eradicated from OEMs supplier's list. The change could be clearly observed in the Airbus supply chain model. For the production of A380, Airbus was involved in more than 200 Tier 1 suppliers which reduced to 90 at the time of production of A350 (Chabanon, 2016).

Airbus and Boeing are now inclined in reversing the situation, where their suppliers were enjoying higher profits than them. In order to achieve their objective, OEMs are introducing new terms and conditions for the suppliers. These terms and conditions are introduced in form of initiative towards achieving success, and the suppliers have to abide by these conditions in pursuance to work with OEMs.

Partnering for Success is an initiative introduced by Boeing which focused primarily on cost reductions. Boeing initiative of partnering for success embraces a shift in focus from technological innovation to process innovation, which could help Boeing to increase profit margins. In order to do so, Boeing pressurized their suppliers to reduce cost by 15% in order to stay in supply list of Boeing. The initiative was applied aggressively and any supplier unable to meet the cost cutting target was removed from the supply list.

Later, Boeing introduced Partnering for Success 2 (PFS). The goal of this initiative was to achieve cost reductions up to 25% and revise the terms of creditability with the suppliers. Boeing wants to stretch their accounts payables which will make it difficult for the suppliers, as they would need liquidity to keep on running the operations. In addition to this Boeing is interested in gaining the control of after sale service or in other words aftermarket service for which they want to negotiate terms with the suppliers. Handing off

aftermarket services to Boeing will result in serious profits cuts for Tier 1 suppliers. In return to all of this, Boeing is willing to offer credits to suppliers for investing in technology and be part of their supply chain.

Where Boeing pursued with PFS initiative, its competitor, Airbus initiated Scope+, a cost-cutting initiative on the A320. Like Boeing, Airbus demanded its suppliers to reduce their cost by 10%. Though Airbus too demanded cost reductions from their suppliers they did not apply the initiative as aggressively as Boeing. Through this initiative, Airbus intended to review its procurement and how the aircrafts are developed and sold in the market. They believe a detailed review of the entire system will help the company to identify the factors that have room for improvement.

In order to address the growing demand of aircraft and to manufacture an aircraft with long life span, Airbus is interested in opting for dual sourcing for critical parts and components of aircraft. This strategy will help Airbus to reduce cost as there will be competition between the suppliers and will assist in reducing the risk of shortages of parts and components during increase in productions. Though Airbus confirmed that the Scope + initiative is put into practice, the details of this initiative are not disclosed to public (Hepher, 2015).

The director of Consulting AeroDynamic Advisory Kevin Michaels (2017) states that the OEMs, especially Boeing, are reinventing the supply chain of aerospace industry which is an indicator of extensive vertical integration in the future. He says that Boeing is working its way through the aircraft and assessing every component by categorizing them in three parameters. Firstly, they are focusing on the strategic technology involved in the aircraft. They are differentiating between the core strategic activities and non-strategic activities and rating them according to the intensity of its importance in operations. As previously discussed in the Literature, this is what the Kraljic matrix indicates as well. Secondly, they are assessing if it makes business sense to retain the strategic advantage in their own hands or to pass the strategic technology on to the suppliers? Lastly, Boeing is concerned as to whether taking the entire production in their own hands would result in higher margins or not (Bogaisky, 2018).

All these changes and reassessing of the supply chain is an indication that changes in the aerospace industry are visible and all the companies are pursuing strategies that would help them retain their positions in the industry. For Boeing, Tier 1 strategy did not work well, therefore experimenting with vertical integration is justified but this experiment could lead to huge profits or disastrous consequences. In the long term, it still remains unclear if vertical integration will displace outsourcing as the dominant strategic framework for the industry.

3.4.2. Suppliers in Aerospace Industry

While outsourcing has been common in the industry it has also led to efforts from suppliers to move up the supply chain and gain greater power in their relationships with OEMs. The OEMs too are making efforts to maintain the balance of power in their relationships. They want to maximize their profitability as well causing undue stress and pressure on the suppliers especially with the threat of OEMs pursuing vertical integration. As determined earlier, supplier selection and maintaining supplier relationship is one of the core aspects of purchasing strategy.

Cousins (2005) stress on the mutual cooperation between buyer and supplier in terms of concurrent business objectives and complementary technological innovation. Lamming et al. (2001) further refines this narrative of buyer-supplier collaboration to be an ever changing and continuous evolving process. Graham et al. (2002) and (Hassen et al, 2012) give a comparison between the U.K. and Quebec aerospace interfirm relation dynamics. Both point to the fact that buyers dominate the decision making in the industry and the suppliers align themselves to it.

Graham et al. (2002) examines buyer-supplier relations from U.K aerospace industry. As per their study the U.K. aerospace industry is characterized by contracting, where the buyer outsources the contract of production to the main supplier. The supplier in these circumstances is autonomous to choose tier 2 or tier 3 suppliers and be responsible for the whole supply chain. Utilizing value-chain framework, they conclude that the buyers are more focused to the inner functioning of their organization and thrusting their objectives upon suppliers without trying to understand them.

The buyer-supplier relationship can be divided into two groups – partnership and dependence. In a partnership, the buyer has specialized contracts with many suppliers. However, there is a possibility of leakage of sensitive information to competitors when the involved suppliers serve more than one buyer in the market. In a dependency, the buyer supplier relationship is exclusive. Hence, the supplier has undue leverage over the buyer. Along with that, any disruption in business will also risk the supplier to go out of business alongside the buyer. Among the two, the firms in the U.K. aerospace prefer partnerships i.e. supplier diversification (Graham & Ahmed, 2002).

Smith et al. (2005), while focusing primarily on the aerospace industry in UK, argue that increasing competitive pressures are changing the course of the industry globally. Initially the competition was based on technical capabilities of the company and the differentiation it can offer, but a change could be clearly observed in the industry as factors like cost and value are now equally significant.

In order to comprehend the needs of OEMs, Aero Montreal along with Sous-Traitance Industrielle Quebec (STIQ), issued prerequisites for becoming a world-class supplier which serves as a guideline for all current and potential suppliers for OEMs. It also serves as a guideline for suppliers to develop and enhance their critical skills and add value to their current product. The papers discuss the inadequacy of the suppliers in Montreal specifically to fulfill the demand of the prime contractors for which the prime contractor's search markets across the border where their demands can be met while simultaneously achieving cost efficiency. In order to develop and restrain the position in the aerospace industry the suppliers have to build solid competencies in 7 spheres which are demarcated as “Global Competitive Thrusts.” This encompasses leadership and management; customer relations and customer diversification; key competencies and differentiating products and services; innovation and technology; productivity and efficiency; proactive management of the supply chain; sound and secure finances. These seven spheres are then further divided into general requirements and operational requirements (AeroMontreal, 2009).

Hassen et al. (2012) examine the proximity of the firms in aerospace industry in Montreal. Their observations indicated that, initially, the supplier-buyer relation tends to be price based over a short term. However, with emphasis on quality and on time delivery alongside with price, the relationship gradually progresses towards long term collaborations. The buyers or the main contractors are independent in their decision making and hold a sway over the market. The suppliers or sub-contractors revolve their work around the agenda of the main contractors (Hassen, Klein, & Tremblay, 2012). The authors state that the suppliers reduce their dependency on the buyers by diversifying their businesses into other sectors as well.

Rebolledo et al, (2011), presents a buyers point of view in their study and focus on the inter-firm learning. They argue that many buyers in the aerospace industry focus on cost reduction aspect while deciding on relations with their supplier. Buyers negate the aspect that forming relations with the suppliers can help them more as this presents a learning opportunity. They emphasize on the importance of organizational knowledge which they believe is an important element for innovation and long-term survival. According to their research buyer should employ efforts to strengthen their relations with the suppliers in terms of trust, socialization, collaborations and information sharing. This partnership approach can help both suppliers and buyers in creation of knowledge and innovation.

It can be seen that there are a number of pressures on suppliers in the aerospace industry. The OEMs hold a great deal of power in the relationship and are forcing a reduction in the

total number of suppliers. There are also significant cost reduction pressures on suppliers. For example, Boeing has warned its suppliers that in order to be in Boeing's supply list, they have to reduce their cost by 15 to 25%. At the same time, the suppliers that are able to perform up to the ever-increasing standards of OEMs are being rewarded with much closer technical collaborations and partnerships. While OEMs have reduced their total number of suppliers, they are also much more dependent on the suppliers that remain.

3.4.3. Change in the Suppliers Strategy

As discussed in the previous subsection, the relationship between suppliers and OEMs has become much closer over the years. What was initially a strictly contractual partnership has now evolved into an involvement in every stage of production. OEMs are now involving suppliers in the design and research phase for their products as well. Though this can be an extremely innovative and productive step towards growth, it has had its own demerits.

As suppliers specialized in the production process, they looked to expand. This led the OEMs to invest in the productive suppliers that were part of their prescribed supplier selection criteria. Where investment in suppliers led to long term healthy relations with suppliers, it also increased the dependency of OEMs on the suppliers. With the increase in the number of airlines operating in the industry and the demand for new and innovative aircraft, the demand and requirements of the OEMs became highly dynamic. They wanted the suppliers to increase production of high-quality product, achieve cost efficiency and invest in the research and development of the innovative technology.

In order to achieve cost efficiency and increase effectiveness, the OEMs started to review their supply chain in order to seek solutions for eliminating costs. The first step was to reduce the total number of suppliers as dealing with a large number of suppliers was creating additional costs. One of the OEMs introduced the concept of vendor managed inventory. According to this concept the OEM will outsource C- class products to the suppliers. These products would not only be manufactured by the selected suppliers but these suppliers would keep these product in their storage unless the OEM requests for delivery (Handfield, 2012). This reduces inventory holding costs for OEMs while increasing the burden on suppliers to invest in additional space, staff and capabilities.

With these changes happening in the industry, suppliers are striving to secure themselves in the market. They are trying to increase their capabilities to be the prime suppliers in the list of the OEMs. In order to do so some of the suppliers are starting to acquire or merge their operations with other suppliers in the market. These mergers and acquisitions will

allow the suppliers to have more capacity to operate, eliminate competition and adjust with the changing requirements of the OEMs.

One of the examples for such an acquisition is between Rockwell Collins and United Technologies which recently went through. It was suggested that approval of this acquisition will create a huge underlying shift in the industry as this is going towards the creation of super suppliers (Lynch, 2018). To protect other suppliers in the market the European Commission made it clear that United Technologies acquisition of Rockwell Collins will not have any advantage over other suppliers and neither will they have any extra power in the market to operate or shutdown any other suppliers. The question here is to analyze whether this statement is true.

The two major suppliers of Bombardier, United Technologies and Rockwell Collins (Tier 1 suppliers) are supplying their products to Bombardier. After the acquisition of Rockwell Collins by United Technologies, the new entity will be manufacturing almost 40 percent of the products for Bombardier (Lynch, 2018). This means that not only will other suppliers be affected but the creation of a Super Supplier will shift the balance of power in the relationship away from the OEM. In light of this development,
Boeing's strategy appears to be safer. Rather than the suppliers following a vertical integration strategy and putting the position of OEMs in question, it is better that the OEM takes the initiative of creating a self-sufficient environment where they can form mergers and acquisition and partner with their supplier to form a healthy supply chain and retain their power.

3.5. Conclusion

Over the course of this chapter we provided an overview of the global aerospace industry in order to identify key trends in purchasing as well as highlight the evolution of purchasing strategy. The chapter starts with a description of the sectors and structure of the aerospace industry followed by a global market view. The global industry is seeing great growth, particularly in emerging markets such as the Asia Pacific region. The aerospace industry has a unique hierarchical structure that revolves around the OEMs and is based on a number of tiers. Over the years, OEMs have reduced their own risk exposure and moved more responsibilities down to Tier 1 and lower tier suppliers. This led to a gradual transition from vertical integration to adoption of outsourcing in the aerospace industry as it offered lower risk and extended reach to OEMs.

To provide a structure for outsourcing Bombardiers introduced Tier 1 approach, which was followed rigorously. Though outsourcing provided answers to many problems faced by OEMs, it also created new risks of knowledge spill over and empowered suppliers. Tier

1 approach did not work for all the OEMs operating in the aerospace industry. In fact some companies who followed Tier 1 approach had to bare cost outruns, delivery delays and quality issues.

Since then different OEMs have been using different strategies to manage suppliers including Bombardier's Tier 1 strategy, Boeing's Partnering for Success 1 and Partnering for Success 2 as well as Airbus' Scope+ strategy. The industry has recently seen a trend towards vertical integration with mergers between suppliers and new joint ventures being formed between OEMs as well.

Suppliers in the industry are facing increasing pressures to deliver more innovative products at lower costs and taking on greater responsibilities in the supply chain. The formation of new super suppliers has the potential to change the dynamics of the buyer supplier relationship, however it still remains heavily in the favor of the large OEMs that dominate decision making in the industry.

In the next chapter we will discuss the different factors that are shaping purchasing strategy in the aerospace industry.

4. Chapter 3: Factors Impacting Purchasing Strategy in the Aerospace Industry

As observed in the earlier chapters, OEMs have been reinventing their purchasing strategy by changing sourcing strategy, the supplier selection criteria and the relations shared with suppliers. This chapter aims to identify the factors that are creating the need for change in the aerospace industry and purchasing strategy in particular.

4.1. Globalization

Globalization is a process through which different societies and economies become tightly integrated. The increased integration of world economies commenced due to the growth of international trade and increased factor mobility (Rahimi & Noruzi, 2011). However, globalization is more than just international trade. The branches of globalization extend to telecommunication, politics, societal integration and much more.

Ritzer et al. (2010), in their book incorporate multiple considerations of past scholars and arrives at a composite definition that perhaps could be applicable generally. They define globalization as a "trans-planetary process or set of processes involving increasing liquidity and the growing multidirectional flows of people, objects, places, and information as well as structures they encounter and create that are barriers to, or expedite, those flows." In a side-step from the definitions provided earlier, Ritzer does not assume integration to be an inevitable outcome of globalization; he instead defines the process itself as globalization.

Moving forward with Ritzer et al. (2010) understanding of globalization, and administering it to the aerospace industry in general, there are 'phases' that appear to highlight how the aerospace industry as a whole has progressed. AeroStrategy (2009) lists two distinct phases: Globalization 1.0 and 2.0. In their report on globalization trends, some variables including talent recruitment, manufacturing, and engineering coupled with research and development have been included to draw a holistic picture of the aerospace industry. The significant difference between these two phases rests in the involvement of original equipment manufacturers (OEM). In phase 1.0, the OEMs preferred to source critical equipment such as aircraft parts, avionics components, and sub-assembled frames and other equipment from foreign suppliers. For instance, China uses Russian manufactured engines for its fifth-generation fighter jets J-20 and J-31. These engines are made according to the specifications of the Chinese buyers. This collaboration is an example of phase 1.0. The collaboration between China and Russia may change as China is making breakthroughs in military technology and gearing towards self-reliance (Chow, 2018).

However, AeroStrategy (2009) suggests that phase 2.0 of globalization has now ushered in due to falling communication and transportation costs. This has allowed OEMs to integrate engineering and other aspects of the aerospace industry more tightly. This can be done via joint-ventures: Eurofighter Typhoon, a join-fighter program that the United Kingdom, Germany, Italy and Spain promulgated, is an example of phase 2 of globalization in the aerospace industry where different components of airplanes were manufactured in participant countries via a joint-venture (Typhoon, 2018). A similar program in Asia is the JF-17 Thunder jet that Pakistan and China are manufacturing jointly. The jet is assembled in Pakistan while several of its parts are manufactured in China (News, 2009).

From the period of 1990 to 2009, there have been more than 200 announced joint-venture programs for the development of aerospace technology across the world. One of the reasons for this has been trade liberalization practices adopted in Europe and elsewhere post-Cold war, which has led to the effective dissemination of engineering research as well as the establishment of manufacturing complexes allowing stakeholders to allay human labor costs. Another aspect of joint-venture programs is that stakeholders are able to effectively share costs and research to come up with a product for their respective markets. This gives the product a greater chance to be successful in the market (Bank, 2005).

After reviewing the AeroStrategy (2009) report on globalization certain facts stand out. The OEMs are benefiting from globalization as they gain access to foreign markets and benefit from their specializations. They can import specific products and assemble them in the home country. However, OEMs are dedicated towards maximizing their efficiencies. For this reason, Dana Hullinger, Director of Supply Chain Strategy at Boeing suggests collaborative initiatives. She states that Boeing has an extremely complex supply chain with over 5000 suppliers in more than 30 countries handling more than 120,000 different purchase contracts. Under such situations, factors like managing quality of the product, technological obsolesce due to innovation and information theft could be extremely challenging. However, collaborative initiatives can help to mitigate these challenges (Boeing, 2016).

4.2. Emerging Countries

The increasing contribution of BRIC (Brazil, Russia, India, China) countries in the aerospace industry is a rising concern for many leaders in the industry. These countries are emerging as a threat to many countries that have enjoyed big chunks of profits by operating in the industry for years. For countries like Canada, aggressive competition in the market by BRIC countries is not only a threat to their market position but could also

lead to significant economic loss due to the immense importance of the industry. Countries like Brazil, Russia India, and China realize the benefits of the industry and therefore are strategically aligning their resources to build sectors that would help them mark their presence in the industry.

Factors like availability of cheap readily available labor, low cost of manufacturing and production and ease of operating overseas due do globalization are making the BRIC countries an enticing opportunity for major companies like Boeing and Airbus. As previously mentioned, the aerospace industry is an extremely capital-intensive industry and cannot be operated effectively without the support of the government. The respective governments of BRIC countries realize this fact and are aware of the economic advantages that this industry could bring. Therefore they are starting to extend significant institutional support to their local aerospace industries. Boeing, Airbus and Bombardier are also keen to explore markets abroad and utilize their lower factor costs.

The BRIC countries started as Tier 2 or Tier 3 suppliers who were manufacturing small parts of aircrafts or were customers of OEMs like Boeing. With higher growth rates, these countries now want to move into a position of dominance in the aerospace industry. They are interested in being powerhouses as they are aware of the strengths and opportunities this industry holds for them. They are already enjoying the advantage of low cost of production, and by working with major aircraft manufacturers, they have learned the use of advanced technology and are aware of the constant need of innovation in the industry. These countries have therefore started putting their knowledge into action and have emerged as competition in the industry.

Today the prediction made in McKinsey (2008) holds true. Brazil is operating successfully in the market with Embraer, China with COMAC, Russia with United Aircraft Cooperation and India with Hindustan Aeronautics Limited. However, despite their visible presence in the market they do not pose a risk on the market position of Bombardier for the foreseeable future. China, for instance, started with the structural component manufacturing for Airbus and Boeing and fuselage for Bombardier. Once China gained proficiency in the manufacturing of parts and components, it started assembling aircrafts for Airbus by establishing a base in China, and now they have their own aerospace company where they are operating as an OEM.

After observing the case of China, it can be concluded that the big two's (Airbus and Boeing) strategy of global sourcing has led to a knowledge spill over. China has taken advantage of this spill over along with the support of their governmental institutions to enter the industry while Brazil already has an established aerospace industry due to the

presence of Embraer. Russia and India are also fast developing their local industries even if there is still significant room to develop.

4.3. Technological Advancements

The aerospace industry is an industry that requires innovation at every step of the production process. In order to be competitive in the market and grow, companies are required to build superior technologies that would support their product from its conceptualization to its production. The fast rate of technological innovation and the competitive advantage bestowed through owning the most advanced technological capabilities has a deep impact on the purchasing strategies of firms in the aerospace industry. In order to understand the point of view of researchers over the course of time regarding technology and its importance, this sections covers broad spectrum of time from 1990 to 2015.

Technological progress had a significant impact on economies, and this will continue in the future as well. Investment in Research and Development is essential for companies that want to acquire advanced technologies. The aerospace industry has complex characteristics as it is an agglomeration of several industries that produce a variety of products. The industry requires continuous up-gradation of technology for tangible (physical parts like engine, propellers) and intangible (software) categories. Being a multi-technology industry, it needs to manage technology transfer continuously and effectively (Granstrand et al., 1990).

Petroni et al. (2000) propagate that research and development play a significant role in the effectiveness of the implemented technology. This industry has the potential for both spillovers and productive cross-fertilization. Research and development in the aerospace industry may have high costs, but the results have a beneficial impact on the industry and its subcategories. As the costs are incredibly high, the risk for technology transfer requires a complete analysis of aspects like selection and acquisition of technology. Investment efficiency depends on correct analysis.

To chart all the technological advancements in the aerospace industry would be an impossible task. Therefore, such advancements would be referred to as “trends” affecting the aerospace industry as a whole. The aerospace industry is highly complex due to its strong technical requirements, the need for continuous system upgrades and high development costs (Lilliecreutz et al., 2001). The outsourcing of both design development and production has become a norm in the aerospace industry. The cost and complexities involved in the manufacturing process force producers to be involved in the global product (McGuire, 2007).

Park et al. (2010) emphasize the need for a decision-making system that assist research and development planning in aerospace and other multi-technology companies. For this purpose, they use patent information and suggest that a technology transfer analysis must be carried out to provide a guideline for technology transfer, to achieve maximum investment efficiency while reducing the risks from internal and external factors. Currently, several firms face pressures regarding core competencies in innovation, productivity, and globalization and as they specialize, the need to have flexible, competitive strategies is manifestly evident. Therefore, technology transfer is inevitable in many cases, but it may have disadvantages if the acquisition is not wise.

Traditionally, handmade drawing by engineers and designers have been used in the process of devising what to make and how to make it. These drawings were drawn to carry, maintain and control the product definitions, in order to reduce the risk of misunderstanding. However, since Chen et al (2002), introduced the idea of generating 3D drawing through computer aided designing (CAD), which significantly reduced misunderstandings and risks of tedious errors. Subsequently, digital modeling techniques are replacing hand-made drawings. Visualization using advanced software also allows altering designs with ease and arriving at precise mathematically driven aircraft models. Improvements in digital modeling product suites are already enticing aerospace and automotive industry. Quintana et al. (2010) conducted 34 interviews in two Canadian aerospace companies to identify the barriers that are holding the complete implementation of model-based engineering (MBD). With the invention of CAD and CAM, model-based engineering is not only the best vehicle to deliver detailed product information to the supplier, but also the most suitable platform to provide valuable insights into the technicalities of the products.

Improvement in technology have impacted purchasing in a number of different ways. While the benefits with regards to reduced cost and increased scalability are obvious; technological improvements in communications have made the job of purchasing functions drastically easier. Improved communications tools allow purchasing managers to monitor and manage outsourced processes much more effectively. Modern advancements are also reducing the cost of labor by replacing it with technology. Visibility in the supply chain is another area where technology has positively impacted purchasing professionals and allowed them more secured access to global suppliers.

In the next subsections we briefly discuss a few of the technological innovations that are predicted to have the largest impact on the aerospace industry in the near future.

4.3.1. 3D Printing/ Additive Manufacturing

Advanced technologies have opened a whole new ray of opportunities and potentials to gain competitive advantage in the market. Customers are seeking ways to achieve higher profit margins while being competitive in the market at the same time. 3D printing, also known as additive printing, is offering a solution to some of the problems faced by OEMs and suppliers. Previously, 3D printing helped in making prototypes with the help of polymers but now manufacturers have access to metal additive manufacturing as well. 3D printing allows manufacturers to create aircraft parts with multifaceted geometries efficiently and effectively. It is true that once 3D printing was used cautiously for the production of aircraft parts due to reliability issues. However, now it is expanding at a great rate due to its advantages both to customers and manufacturers.

The use of 3D printing has not only increased efficiency but also made the production process faster. By pairing 3D printing and CAD, OEMs can increase the pace of work significantly. Firstly, rather than deconstructing the intricate design in multiple parts and then manufacturing and assembling them, 3D printing allows the manufacturing of complex designs as a single part. Secondly, with the automation of the entire work process from labor intensive to capital intensive, the speed of production has increased.

Thirdly, as the process is automated the use of raw material is very efficient leading to minimized waste. Fourthly, as customers are looking forward to durable but lightweight parts, 3D can offer a solution to it. Manufacturers can produce lightweight parts by using quality lightweight nickel and titanium. The use of such materials will help increase durability, and as 3D uses raw material efficiently, the cost could be monitored accordingly. Lastly, 3D printing has allowed the manufacturer's operations to be leaner. With the help of this technique, manufacturers can base themselves closer to customers and produce according to their needs.

For example, if an aircraft part needs to be replaced, the part needs to be ordered or checked in the inventory of the base then it would be dispatched to the airport. Meanwhile, the airline bears the cost of having the aircraft on the ground for hours, until the product reaches the airport after passing its supply chain, which could be in hundreds of thousands of dollars. This cost is now avoidable, with the help of 3D printing as manufacturers can formulate this part in a warehouse next to the airport.

In the aerospace industry, suppliers have increased the use of 3D printing. Initially, 3D printing was used to manufacture less critical products, but with the advancement of technology and after exploring its potential, the manufacturers are using it for the production of complex and sensitive parts of the aircraft like engines. Especially

companies with high demands are pursuing 3D printing so that they can meet their production targets on time. Companies like Airbus and General Electric (GE), both are using 3D printing extensively in their operations. Airbus uses this technique to produce more than a thousand parts of the A350. GE, on the other hand, had produced its 1,300 HP advanced turbo engine with the help of 3D printing (Warwick, 2016).

Though the OEMs are excessively using 3D printing for the production of the aircraft, there are studies that are skeptical of its success and the extent to which this technology could be used for manufacturing (Roca et al., 2017). They discuss the possible issues associated with 3D printing including regulations as to how it will be implemented in future, which industries will benefit with its use, its use and success when manufacturing metallic 3D products and certification issues. Besides these legit concerns, the researchers highlight the advantage of using 3D manufacturing which is cost competitiveness.

The future of 3D technology in aerospace seems to be bright, owing to the growing advancements in 3D printing technology as a whole and it is prospective cost-effective printing method that could slash operational and manufacturing costs in any industry. Deloitte (2014) highlights that 3D printing technology is well on its way to being adopted in the industry for the several benefits it is serving. 3D printing has allowed companies to quickly build prototypes of their products to test them for form, fitness, and functionality, which has accelerated design cycles and boosted the overall production cycle. Boeing for example, using 3D technology, developed a prototype in less than 30 days which otherwise would have taken several months to construct. Collaboration is also more comfortable in a system that relies on outsourcing, and even on vertical integration because the 3D software allows for accurate depiction of product requirements that companies can test off 3D printers before mass targeted production.

Besides the interest of companies like GE and Airbus in using 3D printing technology, there is still need of more research in the field to recognize the potential of the technology. Also, the industry needs to assure that this method of production is reliable and resilient. With improvements in technology, 3D printing holds great potential for cutting manufacturing costs and speeding up the production cycle.

4.3.2. Robotic Manufacturing

Aerospace industries have one of the most complicated manufacturing processes which require extreme precision and accuracy at every level of production. Robot deployment in many levels of the manufacturing process is helping OEMs and suppliers to achieve this precision, increase productivity and reducing costs all at the same time.

The prime reason for automation is cost saving. With automation of the manufacturing process, there is less need for human workforce. Moreover, as machines perform tasks according to the instructions provided, chances of errors and mistakes are significantly reduced. Also, raw material is used more efficiently.

The second most important reason for automation is to improve the quality of the product. The robot technology like Flex Track used by Boeing for the production of 777 provides a great example of the improvement in the quality of the machine. Jason Clark, Vice President of Boeing 777, reported that it is a state of art technology. It is easy to use, and the precision and accuracy of the task performed is incomparable. The machine is attached to the body of the aircraft to drill and punch holes in the metal sheet of aircraft. There are many robotic technologies that are adopted by manufacturers for example Fuselage Automated Upright Build (FAUB) developed to build the fuselage section of aircraft and Automated Fiber Placement (AFP) a process that uses computer-guided robots that place layer over layer of carbon fiber to create a composite aircraft structure and Robotic Nacelle Perforation. All these technologies are being used and are continuously helping manufacturers in manufacturing quality products (Anandan, 2016).

The third reason for automation is safety. There are some jobs in aircraft manufacturing that are repetitive and do not require any human input. Such jobs could be tedious and stressful for workers over long periods and could lead to health issues. Also, some jobs could put workers' life at risk or might cause serious health injuries. Such jobs could be replaced by technology which could help in improving efficiency and safety.

Lastly, automation without a doubt leads to increase in productivity. As backlogs of aircraft companies are increasing, there is a rise in demand for OEMs and suppliers to increase their productivity levels. Jason Clark, the Vice President of Boeing 777, stated that the design of original production system for 777 had the capacity and capability to produce seven aircrafts a month, but since automation, their productivity increased and they can produce more than 8.3 aircrafts a month.

4.3.3. Unmanned Aerial Vehicles

A rapid progression and increase in the use of Unmanned Aerial Vehicles (UAV), also known as a drone, has been observed in the aviation industry. UAVs are remote-piloted or auto-piloted vehicles that have currently been used to serve various purposes from recreational activities like movie making to severe jobs like infrastructure inspection, agriculture monitoring, real estate, construction as well as military and law enforcement purposes.

The Canadian Unmanned Incorporation (CUI) is a highly specialized company that provides training and support for UAVs. It has been offering a service of a ground school for UAV operators by providing them training as to how to operate and fly UAVs safely. The Transport Canada and CUI are working side by side as they acknowledge that the industry has potential and require more airspace for testing. The Southeast of Alberta provides a strategic location for the UAV industry as it provides an ideal location for the companies for testing just 100km from Medicine Hat. The Canadian Unmanned Incorporation reported that this location provides almost 2,400km of airspace and offers an altitude of 18,000 feet, making it a significant place to research, develop and test the technology.

In future, drones could be used for industrial applications as well as meteorology, disaster relief, search and rescue, monitoring pipeline and forest, surveillance of borders and much more. However, besides the opportunities and growth potential offered by UAVs, we cannot negate the threat that comes with it. In 2016, two pilots, one from Air Canada and another from WestJet reported that they saw a flying drone in Ottawa and it got close enough to their plane to make them uncomfortable while descending. Not late after, another event occurred in Winnipeg where the police had to take action against a drone flying within 25 meters of a landing plane. These incidents pose a threat not only to the emerging technology and industry but also to thousands of lives that are using air commute.

Realizing the fact that UAVs can be a billion dollar industry if administered properly, the government should provide not only funding for research and development but also provide subsidies to the companies that are operating in the emerging industry. Research and development institutions and government should take an active part in developing UAV technology as its full potential is still undefined. The University of Toronto received a funding of $1.65 million by Natural Science and Engineering Research Council of Canada to train 150 students in unmanned aviation (Kennedy, 2015). Universities like Carleton and Victoria are offering programs for specialization in Unmanned Aerial Vehicles. These initiatives are leading to develop the interest of students and equip them with a unique set of skills for the future.

To overcome the threats of this industry, the government should also define safety guidelines, policies and regulations for the people who are operating UAVs. Research and development institutions and the government should take an active part in developing UAV technology to its full potential.

4.4. Prime Customer of Aerospace Industry

The aerospace industry serves the needs of two major consumers: the airline industry and the government. A closer look to the role of each consumer is provided to explore their importance in the aerospace industry.

4.4.1. Airline Industry

The airline industry is one of the major economic forces that has a substantial impact on the aerospace industry. In other words, it would be right to say that the aerospace industry and airline industry are highly co-related as the airline industry is one of the prominent consumers of aerospace products and services. Over the past decade, the number of airlines operating around the world has significantly increased. This increase in airlines has directly impacted aircraft manufacturers in two ways. Firstly, due to the increase in airlines, the demand for aircrafts has significantly risen. Secondly, the increase in competition in the airline industry has led to an increase in the demand for cost-efficient and innovative aircraft.

According to a report by Blue Swan Daily (2017), despite rising fuel and labor costs, the global airline industry is going to record a strong earnings performance in 2018. According to the forecast, total profits are expected to increase by 50.34 billion CAD in 2018. All regions are expected to grow and add to the profitability of the industry.

The performance of the industry can be segmented into two sectors: passenger and cargo. The International Air Transport Association (IATA) predicts a healthy growth of passenger commute via air travel in the coming years, estimating that nearly 7.8 billion people are expected to fly in the year 2036, which is nearly twice the number of people expected to fly in 2018.

The incredible rise in air travel is accredited to low-cost carrier services that have appeared all over the globe over the past 30 years, making air travel accessible and affordable to large numbers of people. However, IATA predicts that the next 30 years may not be so smooth for international aerospace, despite a favorable trend for growing numbers. Given its border-transcendental nature, the industry is susceptible to geopolitical surprises.

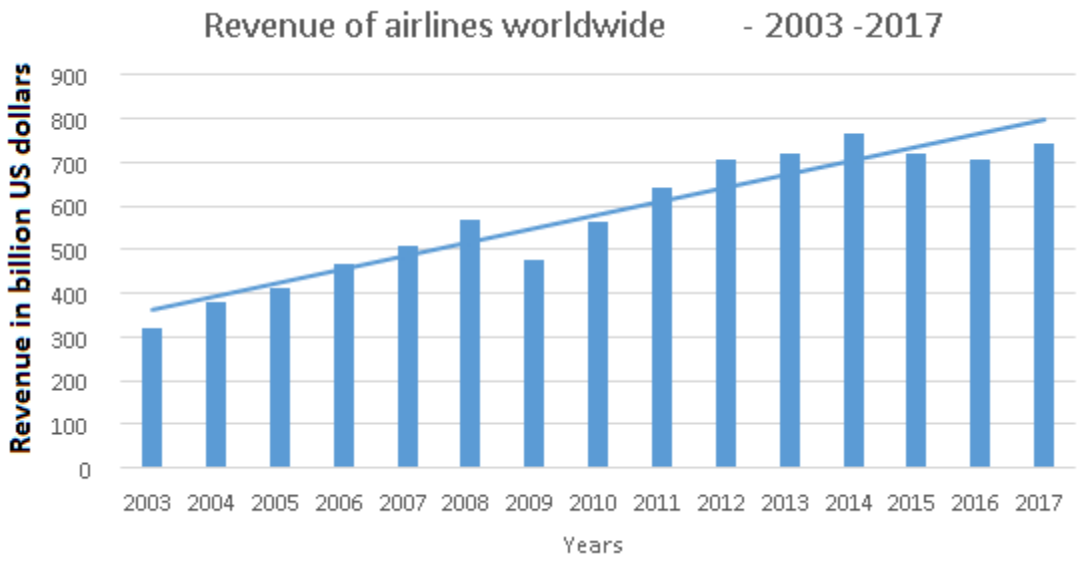

Figure 9: Revenue of airlines worldwide
Source: (IATA, 2017), IATA Fact Sheet Industrial Statistics page 1.

According to the Factsheet issued by the International Air Transport Association (IATA), we can observe an increasing trend of revenues from 2003 to 2008. Though the industry faced a downfall in revenues in 2009 due to the financial crisis, it regained its thrust in 2010 leading the industry in increase in revenues. Airline companies are expected to experience an increase in revenue from $705 billion in 2016 and to $743 billion in 2017 (Figure 9). The increase in revenue was due to the increase in the number of passengers that have been traveling through airlines, and reduction in prices of the tickets. Also due to reduction in the expenses (low fuel cost), and increase in the demand, the airline industry was profitable. According to IATA, regional demand demonstrates that passenger traffic is highest in the Middle East and Asia-Pacific followed by Africa.

Traffic Results

System-wide global commercial airlines	Passenger traffic (RPK), % Year-on-Year							Passenger capacity (ASK) % Year-on-Year						
	2011	2012	2013	2014	2015	2016	2017 F	2011	2012	2013	2014	2015	2016	2017 F
Global	6.3	5.3	5.2	5.7	7.3	7.4	7.4	6.6	4.0	4.8	5.5	6.7	7.5	7.0
Regions														
North America	2.9	1.0	2.3	2.7	5.3	4.2	4.0	2.8	0.0	2.0	2.5	5.0	4.6	4.4
Europe	8.4	4.6	3.9	5.7	6.0	5.4	7.0	8.9	2.6	2.7	5.1	4.8	5.7	6.9
Asia-Pacific	6.6	6.1	7.2	6.9	10.1	10.9	10.4	7.0	5.3	7.1	7.4	8.4	9.9	8.8
Middle East	10.0	14.7	11.6	12.1	10.4	11.3	7.0	9.8	12.0	12.3	10.9	12.9	13.1	6.9
Latin America	11.3	9.4	6.3	7.0	7.6	4.5	7.5	9.3	7.3	4.5	4.7	6.9	3.4	6.7
Africa	1.6	7.5	4.6	0.3	0.0	9.4	7.5	3.2	6.3	4.0	2.5	-0.2	8.2	7.9

Table 3: IATA Domestic and International Traffic. IATA Economic Industry Performance (IATA Economic) (2017)

The intense competition in the industry where there are more than 5000 airline companies operating head on head with each other, obligates airline companies to provide a comfortable experience to their customers in order to gain their loyalty. Table 4 represents the passenger traffic (RPK). Revenue Passenger Kilometers (RPK) is measurement that accounts for each kilometer a paying passenger has flown (IATA, 2017). It can be observed that in 2011 the RPK was 6.3 which later declined in year 2012 and 2013 due to financial crisis. However, the industry regained its momentum in 2014. When compared with 2014, in 2017 the industry had an increase in passenger traffic of about 29.82% (Table 2).

The increase in airlines and number of passenger (air traffic) is a positive sign for the aerospace industry as this calls for an increase in the demand for aircraft. Airline companies will rely on aircraft companies to introduce innovative and reliable aircraft that could help them cater to this increasing demand. It is also worth noting that areas like Middle East and Asia are expected to have the highest growth in number of passengers. OEMs will look to increasingly cater their products for these markets and can perhaps look towards forming new partnerships with suppliers in these regions.

4.4.2. Defense and Security

As discussed before the two main sectors of the aircraft industry are civil aviation and the military and defense sector. The airline industry is the prime consumer of commercial aircraft and government for military jets. The government buys aircraft for defense and security purposes. They are always looking for innovative products for the security of their

country. Due to the global financial issues faced by countries, there were significant budget cuts in the defense sector. This reduction is mainly due to two factors.

Firstly, governments realize that when it comes to funds allocation, military spending is one of the sectors which consumes most of the countries' resources. Countries like the United States of America are paring their resources with other countries to invest in security. Joint investment efforts are expected to help countries in two ways. Firstly, the investment done on the research and production of the aircraft and their parts are shared between the partners, minimizing the burden on individual countries. Secondly, governments can enjoy the perks of accessing the expertise and skills of their partners. For example, the European Union and the USA who together result in the world's most substantial contribution in military and defense are reducing their budget allocations due to fiscal pressures.

Secondly, the countries are looking for advanced technology that could be cost-efficient and effective when it comes to surveillance of the country's borders. Unmanned Aerial Vehicles have grabbed the attention of many governments in this regard and are considered more appropriate for intelligence gathering and surveillance.

4.5. Oil price Fluctuations

The price of crude oil has a strong relationship with the profitability of the airline industry as it is one of the significant expenditures incurred by the industry. One of the reasons why air travel has become so accessible over the past decades, and its strong surge as a preferred medium of travel, is also because of reduction in oil prices when compared with the 2012 oil prices.

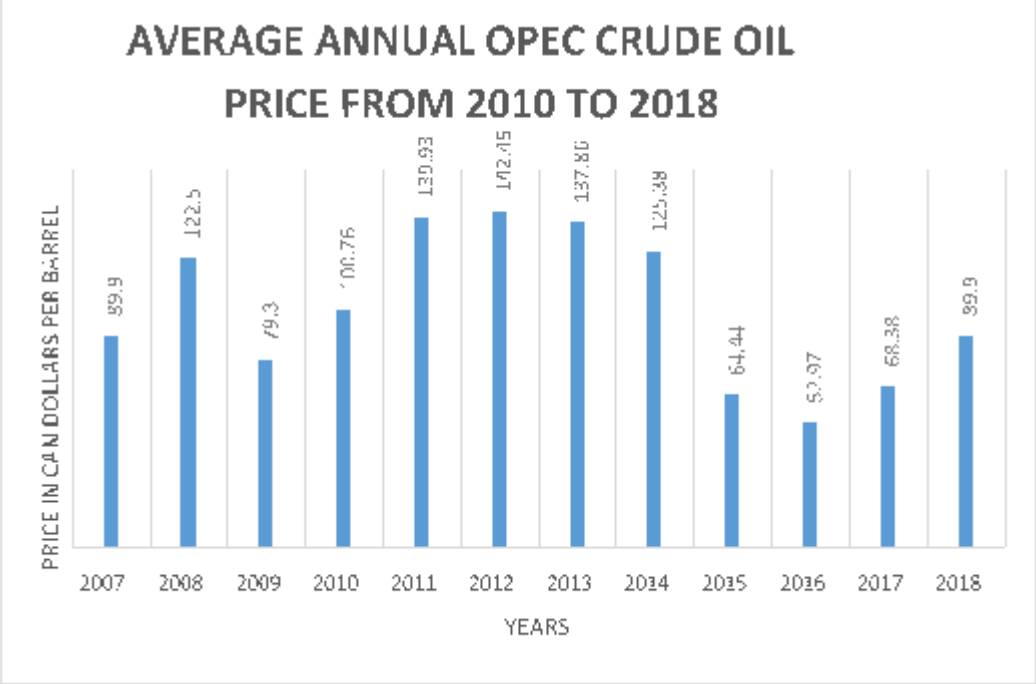

Figure 10: Average annual OPEC crude oil price from 2010 to 2018 (in CAN dollars per barrel) (Statista, 2018)

The data of the past 12 years indicates that there has been a significant fluctuation in the prices of crude oil. From 2008 to 2009 the prices of crude oil were at an all-time low because of the Financial Crisis. The Financial Crisis led to the drop of historic high oil prices as the production faced a downfall for the stability of the oil prices and the demand for oil spluttered to halt.

The prices of oil recovered periodically reaching the heights of $142.45 per barrel in 2012 until crude oil prices hit another fall in 2015. The price of per barrel fell from $125.38 in 2014 to $64.44 in 2015 which is approximately a decline of 48.5%. In 2016, this decline was further extended to $52.97 per barrel creating a further decline of 17.7% when compared to 2015.

The trend of crude oil is essential for the aerospace industry in many ways. Firstly, the trend of oil has a significant impact on the economy and the industry as a whole. The augmentation in oil prices means that it would be hard or expensive to pursue globalization strategy. The hike in oil price leads to an increase in the cost of shipping products making global outsourcing an expensive strategy to follow. When oil prices are high, there is a probability that profit margins and real income for the entire industry will

be low. For aerospace industry, the higher oil price means that the transportation cost would increase resulting in insulation of potential markets. Aerospace companies then would have to rely on their home base for production which would result in high priced consumer products ensuing in less profitability.

The airline Industry's profitability being the prime client of the aerospace industry would also be impacted by fluctuation in the price of crude oil. According to a report by Aviation Lease and Finance Company (ALAFCO 2016), fuel costs represent 30 percent of airline operating costs. Provided that oil prices have remained weaker over the past and is projected to remain in the long term, airline companies have amassed considerable savings to reinvest in their fleets and offer more routes. Investment in the purchase of new aircraft would contribute to the growth of the aerospace sector.

In previous times, high oil prices have influenced development in aircraft technology as the demand for fuel-efficient aircraft increased. New airliners with engines capable of reducing long-term costs have been an attractive prospect for airlines around the world who are actively seeking methods to reduce costs. As oil prices shrink, which has been the case since the second half of 2014, technology-enhanced new aircraft provide a higher return on investment.

Higher per barrel price would lead to low profitability for the airline companies which eventually would leads to a decline in the demand of commercial aircrafts. Therefore, it could be said that low oil prices are desirable by the aerospace industry as it reduces the cost of operations and increases profitability of the industry. Lower oil prices also decreases the cost of moving parts across large distances, providing an impetus for increased outsourcing.

4.6. Exchange rate Fluctuations

Imports and exports are vital towards understanding why fluctuations in the exchange rate can impact the purchasing of products from foreign suppliers. If a country is buying more from other countries than it is selling to them, it means that the country is importing more than exporting. The dilemma of over importing can result in a trade deficit which could result in weakening the currency’s exchange rate against other countries. On the other hand, more exports and fewer imports can result in trade surplus which would eventually lead to an increase in the value of the currency. So, in general, a weaker domestic currency entices exports and make imports expensive. Similarly, a stronger currency obstructs exports and make imports inexpensive.

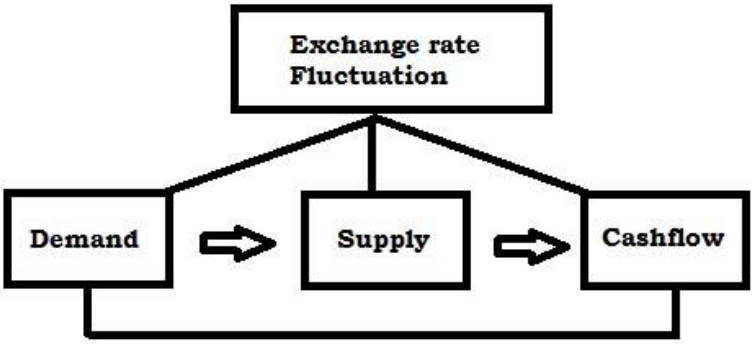

Figure 11: An illustration to understand the impact of exchange rate fluctuations on the aerospace industry

Fluctuations in the exchange can have a significant impact on the demand of the aerospace industry in two ways. Firstly, exchange rate fluctuations can lead to a change in demand for air travel. If the cost of air travel increases, consumers are more likely to opt for substitutes which will impact the profitability of the airline industry. Fewer profits for the airline will eventually impact the investments made by the airline industry in new aircraft and hence impacting the cash flow of the aerospace industry. Secondly, if the exchange rates are high, it is difficult for the airlines operating in emerging markets to match the cost of aircraft hence resulting in a loss of the market and demand for OEM.

The fluctuation in the exchange rate can make an existing attractive market, an unattractive one. For example, the Canadian Original Equipment manufacturer outsources a component to China. Keeping all logistic costs aside, the cost of manufacturing that component in China is $2 compared to $10 in Canada. The Canadian OEM will eventually take advantage of the difference of exchange rate and import the product from China. This exchange rate difference is what made China an attractive market to explore for Canada. Similarly, if the exchange rate of China increases and the same product cost $6 then $2, the attractiveness of the Chinese market will reduce, and the Canadian manufacturer might pursue a cheaper market.

In order to protect the companies from the exchange rate risks, OEMs are involved in financial hedging which helps them secure their investment. Hedging is a technique adopted for risk management, helping companies against potential investment risks and adverse price movements. It helps the companies against the fluctuations of exchange rate, interest rate and other potential risk that results in devaluation of investment (Picardo, 2018).

Though financial hedging can mitigate the risks for the OEMs, it is not a solution for the companies that have diverse portfolios, as the companies have to arrange options for

different stocks which could result in investment of time and analysis. In addition to this, hedging can be counterproductive if nothing goes against the OEMs. For example the companies that had hedging against fuel prices in the time span of 2013 to 2015, did not benefit as much as companies that did not have hedging, as the fuel prices fell. Also, OEMs in the aerospace industry are only interested in hedging for currencies that are steady enough to have a hedging market. Therefore it could be stated that financial hedging can protect the OEMs against exchange rate risk but it can limit them from the exposure of the opportunities in the industry as well.

4.7. Environmental Concerns

There is a huge environmental impact to consider in aviation because aircraft engines consume copious amounts of fuel, leading to emissions of particulates in the atmosphere, in addition to the emission of heat and gases that are detrimental to the climate.

Brasseur et al. (2015) highlights some of the particles and gases that are emitted from an airliner in operation, and they include carbon dioxide, carbon monoxide, nitrogen oxides, sulfur oxides, black carbon and more, all of which are extremely dangerous for human beings. The number of passengers traveling via air double every 20 years, which is bound to increase the industry's dependency on fossil fuels. The increase in profitability of the airline and the aerospace industry comes at the cost of climate change that has caused massive economic loss to the global economy and continues to threaten the very existence of the human species.

The lightning pace of technological advancement has not clubbed the environmental disadvantages that the aerospace industry faces. Comprehensive research from Manders et al. (2016), affirms that the anticipated innovations in airframes, aerodynamics, and engines may take decades to leave any impact before becoming commonplace in aviation. They also rightly point out that governments are keen on incentivizing the growth of air travel industries because it ultimately facilitates the inflow of foreign currency into their respective home markets. Taxes on air fuel and the aerospace industry are minimal, leaving no deterrent for airlines or aerospace manufacturers to develop technology to combat climate change. In order to combat climate change concerns, efficiency in fuel consumption is viewed as a consistent avenue for improvement because air travel is slated only to increase, resulting in more airplanes in the air and more overall fuel consumption patterns.

The aerospace industry is trying to reduce emissions by investing in fuel-efficient technologies, however local and global institutions also have a key role to play in this regard. Gössling et al. (2009), introduce a set of policies that could be implemented by

the institutions and industrial regulatory authority to reduce the impact of emissions. They also suggest that the aerospace industry should be given support so that they could invest in technological development to reduce carbon emissions.

4.8. Institutional Role

Douglass North (North, 1991, p. 8), describes institutions as the rules of the game in order to operate in a society, acting as “humanely created constraints that devise and shape the interactions between humans and also between humans and other institutions”. The structure of the institutions is as such that it promotes a culture of incentivization to promote obedience and homogeneity. In order to develop and boost the productivity of a country, it is vital that the public and private sector of a country work collaboratively to formulate rules that are in the best interest of the society. A stable and prosperous economy is reflective of the presence and well-functioning of supporting institutions.

In a McKinsey survey (Bédier et al. 2009), companies reportedly stated that institutions like government created agencies have a positive impact on the economic value of the industry and executives expect governments to take the initiative that could lead to industrial growth. A government’s multifarious engagements in regulations for capital investments, laws and regulations enforcement, purchasing industrial products and for providing vital infrastructure are some of the factors that affect the growth of the industry.

Governments all around the world have been keen on supporting the aerospace industry from its nascent stages, as well as to its developed manifestations. For instance, the USA, the clear leader in the aerospace industry, when civilian and military technology is considered in tandem, strongly supports innovation and development in the aerospace industry through the means of targeted legislation. Military competitions for defense needs also sustain operations for firms like Lockheed Martin and Boeing. Projects like the F-35 have distributed supplier networks all around the United States, tying the economic interests of several provinces for a single project. The U.S. government has also set up research and development institutions that are state-financed, inclusive of annual individual grants made available to people who want to study aerospace technology in order to sustain the technological thrust. Without such programs, Boeing’s position cannot be sustained in the highly competitive industry (Niosi, 2012).

The success of aerospace industry can also be associated with free trade agreements that have facilitated resource sharing and encouraged companies towards developing strong niches in the global market. Such policies are most visible in terms of impact for emerging countries, where enormous financial expenditure is required to set up an aerospace industry with technical challenges at every step. Due to the nature of the

industry, there are only few countries who can bear these costs and sustain such initiatives. However, when developing countries work collaboratively with the help of governments of different countries, the cost and risk are shared and there are more chances of growth. The BRIC countries, through collective working have established their aerospace industry in the global market which is growing and prospering (Pritchard, 2012). Pakistan's collaboration with China to develop an indigenous light multi-role fighter 'JF-17' is also a successful testament to the prowess and wisdom behind such collaborations.

In an urge to reduce transaction costs and optimize the use of resources, external factors like institutional policies can create barriers for aerospace companies. The institutional environment, hegemony and strength in a foreign country's market has an enormous influence on how these companies operate, given that institutions decide the rules of the game and play a critical role in the success of internationalization process. Institutions like government play a major role in defining the procurement strategies, expansion strategies and structure and size of the firm (Hartley, 2014, p. 29).

When deciding for a foreign market for the purposes of expansion, firms should consider both home and host country environment and the risks and uncertainties that they might face in the host country (Brouthers et al., 2003). Yiu et al. (2002), discuss the impact of institutional theory by examining normative, cognitive and regulatory institutions. They explain that these institutions have different magnitude of influence on the decisions made by multinational companies to enter and operate in foreign countries. Where normative and regulatory institution impact the decision regarding the cross-nation choice of entry, the cognitive institution accounts for cross-firm decisions.

Aerospace is a highly-lobbied sector due to the complicated economic implications tied with the industry that ultimately calls for the presence of state intervention as a rational action. Government lobbying efforts are mostly directed towards protecting the local industry and firms against foreign competition. There are logistical challenges as well, tied with institutional barriers: the industry is known to have tough restrictions for market entry because of the high capital involved that includes expensive and sensitive machinery as well as fixed assets (plants), not to mention the high research and development costs. It is therefore evident that policy making is expected to have a strong sway on the operations of the aerospace industry. There was a time when building strong economic relations with the United States became the center point for the Japanese government's foreign economic policies because Japanese companies were trying to forge a strong relationship with Boeing (McGuire, 2007).

McGuire (2007) further argues that cost and complexities in the aerospace industry invite maneuverers that favor globalization, intertwining the economic fates and interests of the

countries involved in such transactions and interdependent manufacturing. No single firm can perform all the operations, from manufacturing at all tier levels to the marketing and delivery of the product, all by itself. The collaborative network extends the opportunity for all companies – including the suppliers – involved in the process to aim towards cost reduction and achieving economies of scale to do so. China and India have efficaciously exploited cheap resources in their countries, including labor, to encourage the local industry and foreign suppliers to reap higher rewards. Therefore, for nations like Canada that do not enjoy the same benefits that emerging countries enjoy, government intervention and support from institutions becomes a matter of survival for the local aerospace industry.

4.8.1. Government's contribution in Industry

The government has been playing a very significant role in the innovation and development of technology and sciences for decades. Financial aid totaling in billions of dollars to the aerospace industry by the government and institution has helped in making the industry globally competitive. This aid is fundamental for aerospace industry due to its nature of being a capital-intensive and also because of the constant need to innovate. Therefore, most of the aerospace industries are supported by their governments at different levels.

There are several reasons for the government to provide subsidies and capital to the industry. Firstly, over a period of time aerospace industry has become one of the strongest pillars of the economy by its immense contributions to the Gross Domestic Product of the country and also by providing employment to many people of many countries. Secondly, the government can use the aerospace expertise to build advantage for their defense and security sector and can fulfill the security requirements. Lastly, as the industry is continuously investing in innovation and development of advanced technologies to expand and grow, government aid is essential.

The Government of many countries are supporting the aerospace projects in several ways. Firstly, some governments has introduced special programs to support the research and development projects of the aerospace industry. Millions of dollars are invested in the research and development programs where collaborations are formed between private institutions and government to support projects that have potential of success in future. An example of such collaboration can be found easily in Canadian industry where organizations like Strategic Aerospace and Defense Initiative (SADI) Scientific Research and Experimental development (SR&ED) are working hand in hand with government to develop innovative technology.

Secondly, they have been providing subsidies, such as tax credits and grants, for training employees. Thirdly, a change in government procurement could be observed where government is interested in investing their own aerospace industry to fulfill the needs of defense sector (Deloitte, 2018).

Government is also using its political contacts to build markets for domestic manufacturers. They have been extending and formulating more bilateral and multilateral trade agreements so that the manufacturers can address the needs of local and international markets. Lastly, the government has been providing investments to develop and support the infrastructure of the industry which includes funds for institutions to train student in aerospace fields.

4.8.2. Lowering Taxes and Subsidizing

Government policies have always focused on refining business tax competitiveness. The Government understands the viability of having low tax rates that will result in more investments in the economy. By lowering taxes, the government provides a chance to companies to reinvest profits in their businesses and contribute to the growth of the economy.

Also, in order to promote the use of innovative technology in manufacturing, some of the governments have increased the capital cost of allowances. According to a report issued by KMPG, Canadian tax costs were the lowest among the G7 countries (Perspectives, 2018). Such tax benefits mean that the government is providing manufacturers including OEMs and other suppliers with a cost advantage as they can utilize resources at a lower rate. The Canadian government also recognizes the contribution of SMEs and therefore in 2014, they introduced a 4-year program according to which the tax rate fell from 11 percent to 9 percent for SMEs.

The reduction in taxes can allow companies to be a competitive contender in the international market. The lower tax policy allows the OEM and suppliers to reduce their cost in a competitive market. Therefore, in case of biddings it gives a leverage to the firms as they could bid a price to the consumer that is difficult to offer by other competitors in the market. One such example that attracted a lot of hype is when Bombardier won the contract of Delta Airlines. Due to the efficient fuel usage of C-Series, innovative technology and reduced tax policy for manufacturers in Canada, Bombardier bid an unmatchable bid. However, this bid had to face a lot of criticism by Boeing which is one of the leading companies in the aerospace industry. Though Bombardier was able to win the contract at the cost of forming a merger with Airbus and renaming C-Series as A220.

4.8.3. Training Grants

With the dynamic changes, the demand for highly skilled labor is at its peak. The aerospace manufacturing industry is in search of candidate that can think and execute innovative ideas and are well aware of their job requirements. The Government understands the importance of skilled labor and therefore is investing in programs that could help in renovating the skills of its labor force to keep up to date with the requirements of the industry. Government-sponsored programs like Canada job grants are helping employers to train their labor according to the changing needs of the industry. This program provides a $1,500 grant for each employee so that they can get the right set of skills that are required to perform a job. In order to increase the number of highly skilled labor force, the Government of different countries have launched diverse programs in collaborations with different institutions that allow students and university faculty to access grants and funds for their research and academic purposes.

4.8.4. Free Trade Agreements

A free trade agreement is when two or more countries form a mutual contract or agreement to liberalize the movement of product, capital, services and technology across the geographical boundaries to ensure economic integration (Chadee, et al, 2015, p. 2). Chadee et al. advocate the significance of trade agreements as an opportunity towards the development and creation of a new industry which increases job prospects and leads to economic growth.

Chadee et al. (2015), argue that free trade provides opportunities to the citizens of a country to buy or sell goods or services from another country freely. Transactions of such nature help in economic growth as both the manufacturers and the buyers can take advantage of the free trade policy. Manufactures can exploit the resources of another country to achieve objectives like cost reductions and can access new markets that could lead to an increase in sales. As for the buyer, they have a vast variety of options, and they can choose the ones that best match their needs.

They further elaborate, that free trade agreements help in developing local companies. When the multinational firms enter a country for free trade, they bring along a pool of expertise and experience which the local companies lack. With no barriers to trade, local companies can access the knowledge and latest technologies from their foreign partners. This helps in growing the economy as it opens the opportunity for job creation and creates a competitive environment in the market as the local firms that once were protected by law, now have to strive to sustain their position in the global market.

Where on one side free trade has undeniable advantages, it has its dark side as well. Free trade puts immense pressure on local producers to sustain their position in the market. Sometimes survival is so complicated that some local producers end up leaving the industry. Also, free-trade leads to knowledge transfer and spill over. The spillover of knowledge can attract competition in the market and sometimes could result in loss of competitive advantage (Chadee et al, 2015).

David Noah (2018), supports the stance of Chadee et al. (2015) and further elaborates that free trade agreements remove tariffs completely which is great news for purchasing managers as they it opens a huge arena of options for them. He suggests that free trade can increase the productivity of a country and contribute to the gross domestic product growth by allowing local businesses to opt for cheaper inputs, introduce new technologies and foster innovation and competition. It also helps companies to enhance the competitiveness of their countries' exports in the partner country and attract foreign direct investments.

As for the aerospace industry, free trade agreements have played a major role in expanding the global supply chain of the industry and harvesting advantages by forming collaborations with suppliers around the world. Julie Perrault (2018), a sector advisor at Aerospace Export Development Canada, explains her perspective on free trade agreements by stating that free trade provides an opportunity to broaden the international reach of an industry. Agreements like NAFTA and CETA have played a significant role in the success of the aerospace industry.

4.8.5. Government Procurement

Government procurement is an essential part of the Aerospace Industry. It is defined as procurement of goods and services by the government. Government procurement plays a major role in the demand and success of the aerospace industry. Government procure aerospace products mainly for the purpose of defense and security. In the past decade years there had been an increase in the demand of aircrafts and products for the purpose of defense which is a growth opportunity for the aerospace companies (Deloitte, 2018). However currently the defense sector is going through a transition.

Without a doubt, government procurement markets are worth billions of dollars and offer potential opportunities for domestic and foreign market. Many governments budget for defense sector has been shrinking (Deloitte, 2018). This transition is making the market competitive and in pursuance to stay a head of the competition companies are developing innovative technology to address the changing needs of the sector. The OEMs are aware that the governments are in search of innovative and modern technology. Working with the government can provide an opportunity for the OEMs to understand and address the

need of not only the domestic and foreign markets by manufacturing right equipment that fulfill military needs. Especially with the introduction of “Intellectual Property” rights, the OEMs can manufacture products for foreign countries, avoiding the possibility of technology replications by competitors.

4.10. Conclusion

In this chapter we have discussed the major factors that are having an impact on purchasing strategy in the aerospace industry. These factors were identified as globalization, emerging countries, technological advancements, customer dynamics, oil prices, exchange rate fluctuations, environmental concerns and the role of institutions. Globalization has led to an increase in the number of possible suppliers, their spatial diversity and the purchasing strategies available to OEMs. While the first phase of globalization allowed firms to increasingly outsource production to their suppliers, its more recent second phase has led to more joint ventures and reduced complexity. Emerging markets, especially among the BRIC countries have also led to increased demand and new supplier options for the major OEMs. It is also seen that significant increase in demand is expected for the airline industry in the near future, particularly for lower cost options. On the other hand, the defense industry is seeing reduced budgets and increased attention towards air surveillance options.

Technological innovations can also have a significant effect on purchasing strategies of aerospace OEMs. The key technological innovations that are likely to have an impact on purchasing strategy were identified to be the emergence of additive and robotic manufacturing and the growth of unmanned aerial vehicles. Purchasing strategy is also affected by the growing concerns towards the environment leading to growing demand for lighter aircrafts. We identified oil prices and exchange rate as two macroeconomic factors that impact purchasing strategy in the aerospace industry. Lower oil prices were found to be strongly correlated with passenger demand in the airline industry and hence the demand for aircrafts as well. Exchange rates do not have an impact on demand but can alter the profitability of different purchasing strategies.

Finally Institutions also have an important impact on the dynamics of purchasing in the aerospace industry. They can play an important role in fostering collaboration and promoting research. The government has supported the local aerospace industry in many ways from lowering taxes and providing training grants to lowering trade barriers and funding research.

In the next chapter we will use the information presented in the preceding three chapters to analyze purchasing strategy in the aerospace industry and formulate a framework for

successfully formulating a purchasing strategy that best serves the corporate interests of the firm.

5. Analysis

The three chapters discussed previously have helped us understand what purchasing strategy is, provide an overview of the aerospace industry, purchasing strategy in the aerospace industry and lastly the factors that are leading to changes in the aerospace industry and impacting purchasing behaviors. Before moving forward, it is important to review the key conclusions that can be drawn from this discussion.

In the first chapter we discussed the basics of purchasing strategy focusing on its definition, role, strategic importance and the importance of effective supplier selection and relationship management. It was demonstrated that purchasing can create competitive advantage for a firm if it is recognized as a strategic function, aligned with corporate goals and performed effectively. Treating purchasing as a strategic function requires supplier selection criteria that goes beyond price and relationship management and engages suppliers based on the strategic importance of the goods they supply. Additionally, we recognized global versus local sourcing, single or multiple sourcing and outsourcing versus vertical integration as some of the major strategic sourcing decisions.

In the first chapter we also introduced three different frameworks for managing purchasing. The most important framework is the Kraljic matrix (Kraljic, 1983). This framework divides all purchased items on the basis of their impact for firm profitability and the associated supply risk. This division leads to four categories of products: Non-critical items, leverage items, Bottleneck items and Strategic items. The procurement of these items should be handled using different strategies. We also introduced two different frameworks for managing the buyer-supplier relationships (Cousins P, 2005).

In the second chapter we did an overview of the global aerospace industries. The aerospace industry has two distinct sectors with very different dynamics. The commercial sector caters to private and business travelers. This sector is seeing increased demand, particularly from the Asia Pacific region. The commercial aerospace industry is dominated by two major OEMs: Airbus and Boeing. On the other hand, the defense sector works through government development and procurement for national security needs. Demand in this sector is driven by the constant drive from countries to attain the absolute air superiority fighter. The commercial sector is structured into a hierarchy of tiers with the OEMs on top. Each tier of suppliers buys components from the tier beneath while the entire supply chain is structured and managed by the OEMs. The system is designed to reduce the risk exposure of OEMs. Thus, the purchasing strategy adopted by OEMs has a great influence on how the entire industry functions.

The Canadian aerospace industry has a strong global presence. It is the fifth largest market and is home to the third largest OEM in the world: Bombardier.

At the end of the second chapter we also discussed the prevailing trends in purchasing in the aerospace industry. The industry is unique due to its heavy reliance on innovation, large upfront investments and long production cycles. In terms of purchasing, the industry has seen back and forth switching between outsourcing and vertical integration. Initially the major OEMs were vertically integrated, however with globalization they were incentivized to outsource more and more of their production to lower tier suppliers until the OEMs functioned mostly as integrators and assemblers. Despite the benefits of outsourcing, not all firms had success with this model and some reverted back to vertical integration. This has led to the prevalence of different models in the industry such as Bombardier's "Tier 1" approach, Boeing's PFS 1 and PFS 2 and Airbus Scope+ initiatives. These changes have increased the strategic significance of suppliers to OEMs. They are now involved in the design phase of the aircraft as well as doing most of the manufacturing. This has gradually shifted power towards suppliers, however the OEMs remain significantly more dominant.

In the third chapter we identified the key factors that are impacting purchasing strategy in the industry and discussed their effects. Globalization, growth in emerging markets and an increase in low cost airlines have led to increased demand for commercial aircrafts across the world. Additionally, this expansion has also created new supplier options that can potentially give OEMs greater access to growing markets in Asia Pacific and the Middle East. These factors suggest that purchasing managers will have to deal with increased quantities, tighter deadlines with a larger set of supplier options while paying particular attention to emerging markets.

Purchasing strategy will also be affected by new technological trends and the increased concerns towards the environment. The emergence of additive manufacturing technologies and robotic manufacturing are expected to improve product quality, reduce costs and shorten lead times. At the same time the requirements for more environmentally friendly aircrafts will push OEMs to create lighter aircrafts and increasingly invest in fuel efficient technologies. This could potentially be a key area for creating competitive advantage in the future.

Oil prices and exchange rates are the two most important macroeconomic factors that impact the aerospace industry. We demonstrated that the aerospace industry is strongly correlated with the global economic outlook as a healthy global economy leads to growth in demand for air travel. We also showed that the aerospace industry is most directly impacted by economic changes especially when considering exchange rate. Purchasing

managers need to be aware of these macroeconomic changes when devising their strategies.

Lastly, institutional factors play a major role in the aerospace industry. For the defense sector, government procurement forms the bulk of its purchasing and budgetary decisions decide the industry's direction. Even for the commercial sector, the government plays an important role through tax incentives, subsidies, trade promotion measures and numerous research institutions. Purchasing managers need to carefully consider government regulations as well as making best use of the research and funding support provided by the government.

Once we have established the role of purchasing in the aerospace industry, it is important to understand the competitiveness of the industry to help purchasing managers formulate the business strategy that would help to achieve corporate objectives. As discussed by Van Weele (2005), Porter's Five Forces Model designed by Michel Porter (Porter, 1979) is a significant model to understand the industry and the supplier's strategy. In quest to gage the competitiveness of the aerospace industry we will use the Five Forces Analysis framework.

5.1. Porter's Five Forces Analysis

Porter's Five Forces Analysis helps to analyze the competitive position of an industry and assist managers in developing business strategies. The model is based on the five forces that determine the competitiveness of an industry and therefore indicates the attractiveness of the market. According to Porter, the attractiveness of the market refers to the profitability and growth opportunities for the firms operating in the industry. If the industry has reached a level where there is pure competition in the market and the profits have reached a reasonable level, the industry is considered unattractive.

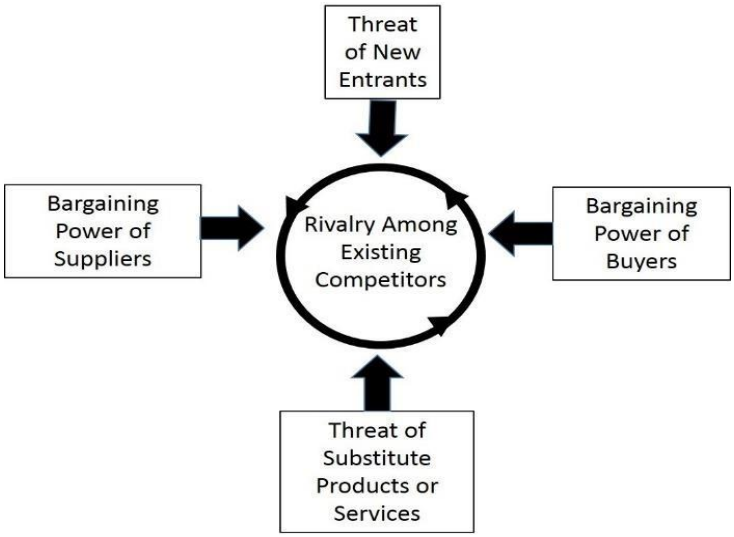

Figure 12: Porter Five Force Analysis Framework (Porter, 1979)

The analysis helps to comprehend a complete picture of the competitive state of the industry by evaluating the internal and external environment. The three forces: the intensity of competitive rivalry, the threat of substitution and the threat of new entrants helps in comprehending the external environment. The remaining two: bargaining power of suppliers and the bargaining power of buyers helps to understand the internal threats a firm has to face by being part of the industry.

5.1.1. Threat of New Entrants

The threat of New Entry refers to the new firms entering the industry that could pose a threat to the existing firms operating in the industry. The impetus for entry is provided by profitability in the industry. If the profits are significant and barriers to entry are low, then the threat of new entrants in the industry is more significant. More entrants result in increased competition which eventually reduces the profitability of the existing players in the market. Therefore, it could be established that the threat of new entrants affects the competitive environment of the industry and impacts the profitability of the existing firms. In the aerospace industry, several factors can help in determining the level of threat of new entrants.

Manufacturing aircrafts requires years of research, experimentation and development. The high research costs and long development cycle themselves form a strong impediment for new entrants. Additionally, this research often requires both funding and technical support from government. In the aerospace industry, governments play a huge role in controlling new entries in the market. The government is aware of the potential

economic benefit that big players like Boeing and Airbus bring therefore they support them by giving funding for research and subsidies.

The cost of start-up is exceptionally high in the industry. The Boeing 777 had an estimated development cost of 10 to 12 billion USD. Similarly, the Airbus A380 had an estimated cost of 16 billion USD. If the companies wish to enter the aerospace industry, they require a significant amount of upfront capital. Furthermore, there is a constant need to improve and invest in technology and achieve economies of scale. Even if the new entrant can arrange the capital essential to enter the industry, new aircraft and engine manufacturing can face a high risk of not getting a positive return on investment for many years due to long production life cycle for an aircraft.

The aerospace manufacturing industry is a well-established industry with a handful of major manufacturers that are leading the course of the industry. These big players are operating on cost and differentiation strategies to gain market shares and retain their position in the market. The big operators like Boeing, Airbus, Bombardier, and Embraer have been in the market for decades and are well-recognized in the industry for their quality. They have a strong brand presence and recognition which is hard to beat by a new player in the industry. The increased importance of reliability in the aerospace industry also means that airlines are unlikely to buy aircrafts from new, unestablished firms.

Another reason that makes it difficult to enter the industry is a concentrated buyer's market. If the new entrant plans to enter as an OEM, the airlines are the end consumers of the firm. As aircraft are costly to purchase, some airline companies pay one-time payment whereas most of the companies buy aircraft on lease spreading the payments of their purchase over some years. This exchange of payments makes a long-term relationship between the buyer and provider, making it difficult for the customer to switch provider.

In order to be profitable, companies need to achieve economies of scale. Aerospace companies like Boeing and GE have achieved economies of scale after years of operation and constant investment in the research and development of the latest technology. It will take many years of learning experience for a new entrant to understand the complex manufacturing, assembling and testing cycle of the aircraft. To enter and make a mark in the industry, the firm would need to have a pool of experienced and educated labor force (engineers) which means an addition of high salaries in the capital required to work. Boeing has designed and developed eight aircrafts from scratch since it's initiation in 1955.

One of the ways that a new entrant can potentially become successful in the industry is through state-of-the-art technology. Currently, fuel efficiency and increased seating capacities are the foremost concerns for airlines. This can help them in not only reducing costs but also improving their carbon footprint. The recent selection of Bombardier's C-Series aircrafts by Delta Airlines was also due to its fuel efficiency. However this case illustrates another impediment towards the entry of new players in the market.

The development of C-Series aircraft by Bombardier faced significant supply chain issues leading to incredible losses for the company. Aerospace supply chains are extremely complicated and require the procurement of millions of parts. Supply chain issues have led to the destruction of many successful firms in the past as well. Douglas was merged with Boeing because it was unable to control the cost of the aircraft and Bombardier's merger with Airbus for the C-series project was also a result of cost overruns. In order to enter the aerospace industry, it is essential to have a strong and cost-effective supply chain. To build an efficient supply chain new entrants require experience, market knowledge, liaisons and capital which is hard find when you are competing against companies like Boeing and Bombardier, who are still trying to configure their supply chain issues.

For the manufacturers of aircraft parts and components, the threat of entrants is more pronounced when compared to OEMs. The capital required to enter the market is relatively low when compared to OEMs, however several other barriers still make entry difficult. The prime barrier is that there are many existing competitors in the market that have been in long-term relations with their buyers. Also, the chief buyers, the OEMs, are reducing their number of suppliers all the time and focusing on insourcing strategy by merging with suppliers that best fit with their requirements. Factors like these reduce the attractiveness of the industry for new firms to enter.

The aerospace industry is an industry that relies heavily on research and development. In such industries, suppliers have to keep up with the changing technological requirements. As an example, the structure of the aircraft has evolved from being made primarily of wood to metals such as titanium and aluminum and now to carbons composites. With each stage the manufacturing complexity, price and research requirements have increased. However, the emergence of new technological advancements such as additive manufacturing can drastically reduce the manufacturing complexity for components and have the potential to increase the threat from new entrants, especially for parts and component manufacturers.

Therefore, it can be concluded that for both the OEMs and their suppliers, the threat of new entrants is low. The industry requires high level of capital, research and experienced

labor to enter the market with high risk of late returns on investment. Furthermore, the institutional support already available to existing players, protectionist sentiments among governments towards local aerospace industry and a strict regulatory environment make it less likely for new firms to enter the aerospace industry.

5.1.2. The threat of substitute products or services

A substitute product is one that offers comparable benefits as the product produced by the firm in an industry. If the product offers the same services as the industrial product and is easily accessible, customers will most likely switch to alternates when the cost of substitution is low. In the case of the aerospace industry, we will observe the force of substitution from three different viewpoints.

The threat of substitution exists if the buyer switches to another mode of transportation. The aircraft might compete with automobiles and trains when it comes to short distances. The substitution to another mode of transportation might be cheaper or expensive for the consumers depending on their final destination. For instance, a short round trip from Toronto to Montreal costs $152 and takes an hour and ten minutes through air transit but via car, the cost of the round trip would be around $136 and will take approximately five hours and thirty minute to reach (Travelmath, 2018).

Similarly, for trains, the time consumed to travel is more than the difference in cost that a consumer may spend to reach the desired destination. Though fast electric trains are gaining popularity these days, there reach is very limited due to the need of rail tracks and the cost of travelling through these trains is similar if not the same with the air transit. For instant, the Shinkasen is Japanese fastest electric train that travel at 224mph. When travelling through this train from Tokyo to Osaka, it costs an individual CAD 225 with a travel time of 4 hours. On the other hand, travel through airliner will cost an individual CAD 360 with a travel time of 1 hour (Travelmath, 2018).

The cost difference when compared with time spent and the comfort that is foregone makes air transit a preferred choice. For small routes, may be in future electric trains might pose a threat on the regional aircraft sector but due to the limited number of these trains and less accessibility, these trains currently pose no threat to the aircraft industry. As for long routes, people are dependent on air transits as this is sometimes the only possible way to reach a destination.

The second viewpoint is if another supplier in the market replaces the aircraft parts suppliers. In case of aerospace industry risk of substitution for airframe manufacturers (OEM) like Bombardier and engine manufacturers like Pratt and Whitney are low as these

companies are the pioneers of the industry. However, the aircraft parts manufactured by Tier 2 or Tier 3 suppliers can be replaced with new products that offer better performance.

Since the OEMs are experimenting with their strategies, companies like Boeing are more interested in acquiring their supplier or build long-term partnerships with them. If the OEMs have invested capital in building the suppliers, the risk of substitution is low. However, the OEM might acquire such supplier in case the supplier needs more capital to keep up with the technological advancements. So, on the one hand, obsolete technology might cause substitution of a supplier, whereas on the other hand long-term partnership programs can help suppliers sustain their position in the market.

The third aspect is the substitution of the leading supplier by the customer. This substitution can occur in case, 0the supplier is unable to comply with the demand of the consumers. The airline companies are in search of providers that could deliver aircraft that are manufactured by the latest technology and are available at the lowest price without compromising on quality. Another factor that the airlines are interested in is to maximize the number of seat occupancy during the flight. With the rising number of passengers choosing air transit as their mode of transportation, there has been an increase in the demand for aircraft.

For Bombardier, the CRJ 700 series/900/1000 and the Airbus A220 (previously known as C-series), are the most significant aircraft offering a seating capacity of 100 to 140 seats. The airline prefers aircraft with a seating capacity of 140 seats for the flights that have relatively less volume of passengers. In case of an increase in the volume of passengers for a particular route, these aircraft could be replaced by other aircraft that offer more seating capacity, for example, a CRJ 700 could be replaced by Boeing 777 which offers a seating capacity of 538 seats. It implies that if there is an increase in demand for air travel the aircraft manufactured by Bombardier may not be preferred for some routes which could result in market loss. There are chances that Bombardier’s aircraft might be substituted by bigger aircraft like Boeing 737 if Bombardier is unable to fill the gap in their product portfolio.

In order to evaluate the threat of substitution, we will be considering each of the aspects discussed above. The probability of substitution of aircraft with another mode of transportation is relatively low. Though it is cheaper for the passengers to travel via car or train than through air, the comfort foregone (due to longer transit time) and limited reach (the places that could be accessed) of cars and trains, the market of aircraft seems secure. Also, the performance of aircraft when compared with the other mode of transportation is superior as there are destinations that could not be reached without the access to air transit making it incompatible.

However, in the case of substitution of aircraft parts and the type of air crafts used by the airlines, the threat of substitution is low to medium. As the industry is continuously investing in the development of innovative technology, the obsolete would be replaced by the new, which means that the chances of substitution are higher if the return from the new technology is profitable for the manufacturers. Therefore, it could be concluded that the threat of substitution in the industry is between low to medium.

5.1.3. Intensity of Rivalry

The intensity of rivalry among the competitors in an industry indicates the strength of the industry. It refers to the pressure one firm can exert on its competitors in the market to limit their potential profit. If the competition in the market is intense, it indicates that the firms in the industry are trying to maximize their market share which eventually will result in higher profitability. The industry is highly competitive with significant players like Boeing, Airbus, Bombardier and Embraer leading the industry. All the companies are trying to increase their market share and profitability by pushing the lines of innovation to produce higher quality products.

Without a doubt, Boeing and Airbus are the two largest companies in the aerospace industry that are in direct competition with each other. They both are producing aircraft with similar sizes and similar technology with only slight differences in their looks. The companies are competing head on head with each other and have formed a duopoly in the industry. Bombardier, on the other hand, is competing against Embraer as they both are producing small regional jets with a seating capacity varying between 90 to 150 seats. COMAC, a Chinese aircraft manufacturer has also entered the industry and is manufacturing aircraft with a seating capacity similar to Embraer and Bombardier. Though these companies operating in the industry are profitable, they have a tiny market share when compared with Boeing and Airbus.

The competitiveness of the industry could be measured by the predictability of future growth of the industry. Currently, almost all the companies Boeing, Airbus, Bombardier, and Embraer have huge backlogs and are attracting new contracts generated due to the demand in the airline industry. The industrial growth is high now as well as in the future. During the last ten years, Boeing has received almost 8978 orders and was able to deliver 5178 aircraft with a backlog of more than 3800. Similarly, Airbus received 9985 orders of aircraft and was able to deliver 5644 with a backlog of more than 4341 orders (Deloitte, 2017). The figures represent the current demand and according to the airline industry, the demand for aircraft will increase due to the increase in passenger traffic.

The recent forecast of airline industry indicates an increase of double the amount of current passengers, reaching a total of 7.8 billion by 2036 (IATA, 2017). The increase in passengers traveling through airlines is an indicator of the demand for future aircraft. Also, as the demand for the fuel-efficient aircraft is increasing, the change of the old fleet of aircraft with the new one is evident. The growing demand makes competition more intensive in the industry. Everyone is trying to win contracts especially when it comes to the two main players Airbus and Boeing.

In pursuance to further measure the competitive rivalry, it is essential to review the barriers to entry and exit. It is indeed an extremely capital-intensive industry which requires years of experience and massive investments in research to secure a position among the competitors. The fixed cost is high, and so are the operational costs. As discussed previously it takes almost 10 to 12 billion to initiate a project which has to pass through the industrial regulators and the government, making chances of a new entry in the market close to impossible. What is unusual for this industry is that factors that make the entry in the industry difficult are similar to the ones that make an exit difficult for the current suppliers. In the past, we have seen that the only way suppliers exit the market is through mergers or acquisitions.

The aircraft itself is a standardized product manufactured according to the strict quality and manufacturing guidelines provided by the industrial regulatory board. Once the companies have fulfilled their standardized requirement, they then can differentiate their products according to their corporate strategy. Airbus, Boeing, Bombardier, and other players follow the differentiation strategy. It is hard to differentiate when it comes to pricing of an aircraft. Therefore, OEMs differentiation strategy is based on their product differentiation like the shape of the plane, fuel efficiency, internal designs, cockpit design and engine which helps them stay ahead of their competitors and gain market share.

The evaluation of the aerospace industry brings us to the conclusion that, competitiveness among firms is intense. The two significant firms Boeing and Airbus are big companies with substantial market shares. Bombardier and Embraer are just offering product for few segments of the industry whereas the product portfolio of Boeing and Airbus is vast, covering all the products offered by Bombardier. What makes Bombardier stand in the market is their continuous research and development that helps them to produce the state of the art technology especially regional jets which helps them protect their market share in the industry.

5.1.4. Bargaining Power of Customers (buyers)

Bargaining power refers to the pressure buyers can wield on firms in order to achieve their desired product or service at lowest possible cost. Buyer's power is one of the forces that form the competitive structure of the industry. The compelling need for change has forced power in the hands of the customers, making them lead the prime contractors in the aerospace industry. The aerospace has two significant buyers: airline companies and the government.

The number of airline companies operating in the airline industry has significantly increased during the last decade. In pursuit of being ahead of their competition in the market, airline companies have to comply with the needs of end customers to win their loyalty and increase profitability. In the past couple of years, the end customer's preference has changed from comfort to low priced tickets. This change of preference has led airline companies to choose suppliers that could offer the latest technology at the lowest price possible.

The increasing demand for cheaper air travel has impacted the aerospace industry both positively and adversely. Where on the one hand, it led to an increase in the demand for aircrafts, it also led to intense pressure from the buyer to use innovative technology and increase efficiency. The airline industry is looking for aircrafts that are light in weight, high in terms of travelers' comfort, low on fuel cost and technologically advanced. The aerospace industry is precisely manufacturing a standard product (aircraft). Though the design, the technology used and seating capacity may vary, all aircraft render the service of transporting people from one location to another. With the intense competition in the market; almost all the prime contractors are offering aircraft with similar technology and similar outlay however the aircraft differs when it comes to amenities. Companies like Boeing, Airbus, and Bombardier are actively seeking solutions to be the preferred suppliers of these airlines.

The concentration of both buyers and the suppliers is high in the market. There is a limited number of airline companies operating in the market, and there are only a handful of OEMs that could address the needs of the airline companies. The airline industry is directly dependent on the aerospace industry for its aircraft needs and is often forced to show flexibility towards delays in order fulfillment. The limited number of OEMs in the market severely limits the options available for airline companies increasing the negotiating power of the OEMs. Another reason why it is critical for the airline companies to select their suppliers wisely is that supplier switching cost could be high. Aircraft are capital intensive products. Therefore, most firms in the airline industry form long-term contracts with their suppliers in order to achieve favorable credit terms. These contracts

bind the airline companies with their suppliers for an extensive period of time, making the switch to another supplier a difficult task.

Also, it is challenging for airline companies to integrate backward and manufacture aircraft. The airline companies lack the capital and expertise needed to manufacture an aircraft which explains why there is a concentration of suppliers in the aerospace industry. Aircraft manufacturing is one part of the equation. What makes it even more difficult for the airline companies to switch suppliers is the after sales services. As the make of every aircraft is different, it is better for the manufacturer to provide maintenance, repair and overhaul services. These requirements make it difficult for airlines to switch suppliers in the long term.

At the same time, the limited number of major airline companies means that OEMs are forced to tailor their products to the needs of the same few customers. It is essential for aerospace companies to become the preferred supplier of the airline industry. Firstly, the airlines purchase a high volume of products which would comprise a large portion of supplier's sales. Once the airline companies select the supplier that matches their specific criteria, the airline companies order a high number of products which could lead to a long-term relation between two companies. The large upfront costs of designing a new aircraft also means that OEMs have a strong incentive to quickly find customers and recoup their costs. Aircrafts also have a long service life which can be extended even further with proper maintenance. These factors weaken the negotiating position of OEMs vis a vis the airlines.

Government procurement is an essential part of the aerospace industry, because it is a significant source of revenue generation for suppliers. Beyond quality considerations, governments have an incentive to hire companies based in their own countries or ones that use local suppliers. Every year the government invests millions of dollars in the research and development of the industry so that the national market can keep up with the technological advancements happening in the industry. The government as a sole buyer has many options when it comes to the selection of suppliers for a particular order. The supplier selection criteria for government procurement, beyond national considerations, is mostly related to getting the best price for the required quality. This has become even more important with recent budget cuts. In order to win government contracts, suppliers have formed collaborative groups to make outstanding bids that are hard to ignore for the government. Boeing and Lockheed is one such example. On several government biddings, both companies made collaborative bids to overcome the competition in the market.

To sum up, the bargaining power of the customer in the aerospace industry is moderate as both the customers and suppliers are dependent on each other. The customers cannot substitute the aircraft with another product, they have limited choices for OEMs and neither can they produce the product themselves. The supplier, on the other hand, is dependent on the customer for the sale of their products and require long term contracts for large quantities in order to be profitable. Suppliers are aware that their customers are concentrated and price sensitive therefore in order to be the favored supplier, they have to match the criteria of the customers.

5.1.5. Bargaining Power of Suppliers

The bargaining power of suppliers is one of the five forces that help to evaluate the strength and role of the suppliers in the industry. Suppliers can exercise pressure and control in the industry through various ways like lowering the quality of the product, increasing the prices or reducing supply. These changes can impact the performance and profitability of the buyer.

The buyers for parts and components, which in case of aerospace industry are the OEMs like Bombardier, are the assemblers of the aircraft parts that they outsource to Tier 1 and Tier 2 suppliers. The OEM select the suppliers based on the supplier selection criteria which is designed following the industrial standards and OEM's specific needs and expectations. Fortunately, the industry has many suppliers that can provide the OEM's their desired product. There are hundreds of companies that are operating in the industry and are manufacturing similar if not the same products for the OEMs. Companies like United Technologies, Honeywell, and General Electrics are some of the influential suppliers of the industry.

In the interaction between OEMs and their suppliers, the OEMs have significant advantages. There are a very small number of OEMs that dominate the market and set the design agenda for the entire aerospace industry. Suppliers are forced to work with the same buyers and cater to their demands. Comparatively there are a much larger number of suppliers available to fulfill these needs, strengthening the bargaining position of OEMs. The OEMs also have great control over the supply chains and structure of the industry. In recent years OEMs have increased pressure on suppliers to take on a greater burden of risk and cut costs. For example, Boeing's PFS 1 program forced suppliers to reduce costs by 15-25% while PFS 2 focuses on terms and conditions such as stretching accounts payables. These measures put great strain on suppliers.

There is an increasing disparity being created between suppliers as a result of OEM strategies. Firms like Bombardier and Boeing are focusing on dealing with only a small

number of suppliers either through closer collaboration or integration. These strategies drastically increase the power of a few Tier 1 suppliers as OEMs have to make large investments in their operations and include them in the design phase. These long-term partnerships have increased the dependency of the OEM on their suppliers and almost rules out the option of switching suppliers.

Thus, it can be said that the aim of suppliers in the aerospace industry is to become preferred suppliers for OEMs and form long term strategic relationships with them. These relationships are key to reducing buyer dependency however they also require significant investments and sharing increased risks with the OEMs. Suppliers need to invest heavily in R&D and expand their capabilities in order to form such collaborations. Since OEMs are looking to reduce both their manufacturing and management burdens, suppliers will have to expand their suite of products as well as taking on the burden of managing the lower tiers of their supply chains.

Secondly, in order to increase the supplier power and reduce competition from the markets, suppliers are joining hands in the form of mergers and acquisitions. The acquisition of Rockwell Collins by United Technologies is one significant example. These mergers and acquisitions will increase the bargaining power of suppliers. Rockwell Collins is known for avionics and information systems, and United Technologies is known for the production of aircraft parts and the information technology system. The acquisition of Rockwell by United will help United to achieve economies of scale, diversify and increase profitability.

In retaliation to these strategies, leading OEMs like Boeing and Airbus are going for insourcing and mergers as well. For example, Boeing has announced to go in business with Safran, a French company that produces aircraft engines, in order to challenge Honeywell and United Technologies. Suppliers such as engine manufacturers are aware that there are few comparable alternatives to their products which provides them a certain level of bargaining power. Nevertheless, the centrality of OEMs in the aerospace supply chain provides them numerous techniques to overpower their suppliers.

After considering all the factors, we can say that supplier power is low in the aerospace industry. However, it is increasing over time as OEMs make greater investments in their suppliers and increase their dependency on a few Tier 1 suppliers. It can also be concluded that Tier 1 suppliers have significantly greater power in the market as compared to lower tier suppliers. The cost of switching suppliers can be high for OEMs due to integration strategies. Also, the trend of mergers and acquisitions can increase the power of suppliers as they can provide the facility of dealing with fewer suppliers for the OEMs and control the price of the product.

5.2. The Purchasing Strategy of the OEMs

In the course of this research, specific patterns of purchasing can be identified that could be acknowledged as evolved trends in purchasing strategy. As we discussed in the preceding chapters, a properly designed and executed purchasing strategy that is aligned with corporate goals can lead to achieving competitive advantage. The thesis is mainly focused on the purchasing strategy adopted by the OEMs in the aerospace industry.

One notion that is evident from the literature is that globalization has led to both new opportunities and threats. These opportunities and risks have not only impacted the OEMs but the suppliers that are working with them. In pursuance to address these threats and opportunities, purchasing managers have been changing their strategies regarding sourcing, supplier selection, supplier relationship management, and negotiations, to ensure best business performance.

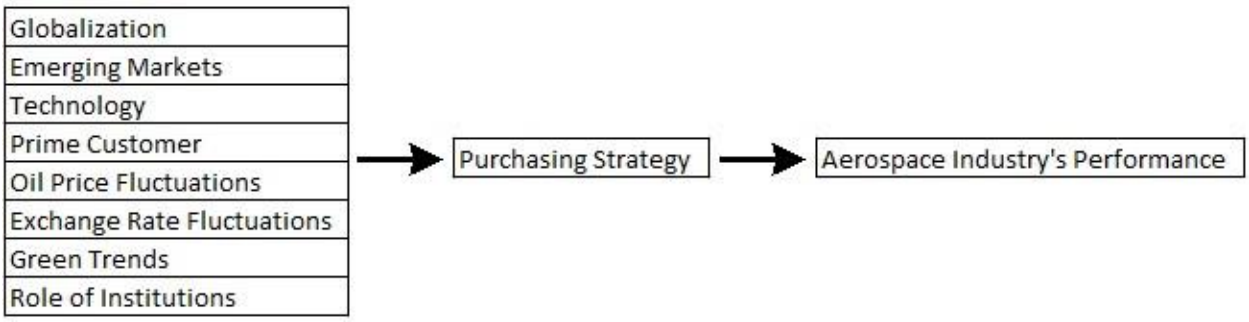

Figure 13: Factors Impacting the Purchasing Strategy of Aerospace Industry

The decision of outsourcing products was made possible because of globalization and the new opportunities offered by free trade. The OEMs took an opportunity to exploit untapped markets by utilizing their resources to meet their corporate objectives of reducing cost. The emerging markets both posed a threat and provided opportunities for the OEMs. Where at one hand it provided a chance for exploiting cheaper resources, outsourcing to these countries led to knowledge spill over which allowed them to enter the industry regardless of the strict barriers and duopoly of Airbus and Boeing.

Drop in oil prices have influenced the demand for aircraft positively and have also made outsourcing a viable option for OEMs as the cost of supply chain will go down.

All these factors have impacted OEMs in different ways and have led them to formulate strategies that could help them fight the threats posed by these factors and exploit the opportunities at the same time. For the purpose of this study, three OEMs were selected based on their market share in the industry. Airbus is the largest with a market share of

45 percent followed by Boeing at 43 percent and Bombardier 5 percent (Deloitte, 2018). In order to identify the implications for purchasing managers, it is necessary to observe the current strategies adopted by the OEMs that are running the wheel of the industry.

5.2.1. Airbus

Airbus is the largest market shareholder in the aerospace industry with its product line ranging from aircrafts with 90 to 500 seats. As discussed earlier, Airbus is following a post Tier 1 strategy with a keen corporate focus on aggressively reducing costs. In order to achieve the desired cost efficiency, Airbus has been experimenting with its purchasing and manufacturing strategy.

Airbus has shown a gradual focus on reducing its own cost burden while trying to deal primarily with Tier 1 suppliers. For the A320, Airbus was insourcing almost 50% of the components delivering the jobs of Tier 1, Tier 2 and Tier 3 suppliers. Later, for the production of the A380, Airbus reduced their insourcing activities, limiting them to Tier 2 jobs and they outsourced all Tier 3 and Tier 4 jobs. According to a report, (Michaels, 2017) Airbus had a hard time, during the production of A380, as they were now working with more than 200 Tier 1 suppliers, making management and coordination a hefty task. Having too many suppliers was making it difficult for Airbus to trace back suppliers in case of quality issues.

In the quest to reduce cost and improve supply chain coordination, Airbus reduced their number of suppliers for the production of A350, engaging with a total of 90 strategic Tier 1 suppliers. These suppliers were chosen not only for their strategic importance but also based on their ability to share some of the risk burden. The result was that only 20% of the total cost burden was on Airbus itself with the rest shared between suppliers. The reduction in the number of suppliers meant both improvements in supplier management and reducing the cost burden on Airbus. Due to the limited capacity of the suppliers to entertain orders, Airbus had to be involved in dual sourcing for certain products.

5.2.2. Boeing

Boeing is the second largest market shareholder after Airbus. To maintain its market position, and grow in the industry, it has been concentrating at gaining competitive edge in the market through unmatchable technological advancements. Boeing has been on a quest to reduce costs and maximize profitability, which is why the purchasing department has been testing different strategies to achieve its corporate objectives.

As discussed earlier, Boeing used the Tier 1 model for the production of the 787 aircraft, but it provided to be unsuccessful. The company expected to be able to deliver the aircraft in a shorter time with lower overall expense. However, the program was delayed several years and resulted in massive cost overruns. More than any inherent problems with the Tier 1 strategy, it was this negative experience that led Boeing to move away from outsourcing. The firm is now pursuing vertical integration and realigning its purchasing strategy (Bogaisky, 2018).

Second reason for Boeing to pursue vertical integration is the firm's belief that outsourcing on the 787 left too little profit for the OEM while increasing its own risk exposure. As there are different tiers involved in the production, Boeing believes that the price of the product is already too high as every supplier keeps their profit margins. They believe that if they omit the role of suppliers and produce the products themselves, they will be able to save on cost. Also due to limited capabilities of suppliers, they had to invest in them, manage communication, bear supply chain cost and in case of delivery bear an increase in lead times. In the new strategy, there is an increased focus on cost cutting, especially the additional cost they were bearing of managing and investing in broad array of suppliers.

Boeing introduced initiatives such as Partnering for Success 1 (PFS 1) and Partnering for Success 2 (PFS). The prime objective of these initiatives was to reduce cost for which Boeing wanted maximize the use of internal resources and capabilities. Both initiatives helped Boeing in reducing the number of supplier and forced the existing suppliers to cut costs significantly, as well as, creating a shift in focus from technological innovation to process innovation. PFS 1 required suppliers to reduce costs by 15% while PFS 2 is requiring a 25% reduction in costs as well as revising the terms of credit.

One reason that Boeing believes this strategy will work are the new innovations in manufacturing technologies. Additive manufacturing has significantly reduced the complexity of producing aircraft components giving Boeing the belief that investing in technology can reduce its dependence on suppliers. The pursuance of vertical integration can result in both advantages and disadvantages for Boeing. The company will be able to exercise more control over their manufacturing system and critical functions of the business. Boeing is also expecting to increase flexibility and traceability in the supply chain since it will be directly in contact with everyone involved in the process from the initiation of the concept of the aircraft until it is delivered to the clients. The company believes that there are more chances of increasing profitability by operating in the lower tiers of aircraft production (tier 2 or tier 3).

But Boeing also realizes the disadvantages of vertical integration. The most significant cost that Boeing has to bear in pursuing vertical integration strategy or insourcing is the

increased structural cost. Purchasing managers realize that if they continue with the insourcing strategy, they will have to invest a massive amount of capital in building the infrastructure to produce the components of the aircraft that were previously outsourced. Not only this but hiring suitable employees, manufacturing all parts from raw material to assembly and later after services could lead them to deviate from their focus, resulting in increased cost.

To avoid all the risks associated with vertical integration, Boeing is planning to form strategic collaborations with its suppliers. These strategic collaborations will help the company to exercise control over their supply and eventually will be able to achieve objectives like cost reduction. One of the models that the company is planning to put in practice is the concept of focused factories (Bogaisky, 2018).

Focused factory strive on a narrow product mix and is created to perform specific operations to fulfill the need of niche market. As the output of the industry is focused to address the need of one set of customer, its overheads and other cost are expected to be lower than the conventional factory. Application of these factories will allow Boeing to reduce their dependencies on the supplier, ensure timely deliveries of product, take charge of the entire operations that are required to manufacture an aircraft and manage cost more efficiently.

5.2.3 Analysis of Bombardier's purchasing strategy

In the previous subsections, we identified the purchasing strategies adopted by Airbus and Boeing and how they are changing in response to both internal considerations and external factors. In this section, we will narrow our focus to the most pertinent OEM for Canada's aerospace industry: Bombardier. Bombardier is based in Montreal, Quebec, in the heart of the country's largest aerospace cluster. It is a multinational company that has engineering and production sites in 28 countries and service centers in 42 countries. It is one of the global leaders in the aerospace industry which is providing innovative business and commercial aircraft and aerostructures and engineering service around the globe. The business aircrafts are divided into three families Lear jet, Global and Challenger whereas the commercial aircraft are divided in two families CRJ and Q-series.

Bombardier is a global leader in the production of business and regional aircrafts, with a seating capacity varying from 5 to 150. This makes companies like Cessna (Textron Group) Gulfstream and Embraer its direct competitors as they are serving the same stream of aircrafts. Aircrafts like Boeing 737, Airbus neo 320 and COMAC C-919 are direct competitors of the C-series range, as these aircrafts fall in the same category of aircraft with 50-160 seats.

Bombardier aims to grow in each of the divisions it serves by optimizing cost structures and maximizing revenue generation. While Bombardier originated the Tier 1 structure in the aerospace industry, it still manufactures a number of components in house. The firm has been designing and manufacturing complex metallic and composite aircraft structural parts and components comprising wings, fuselages, cockpit, engine nacelles, high pressure ducting and electric harness. Bombardier still works with more than 10,000 suppliers in the industry that are spread globally (Jacobs, 2018). These suppliers are either providing the material for the manufacturing of the aircraft or are involved in manufacturing semi-finished and finished parts and components that are important for the assembly of an aircraft.

Table 5 illustrates the names of some of the important suppliers that have been sharing risks of product development for years. Another pattern that ensures the practice of Tier 1 approach by Bombardier is the structure of suppliers. Each set of suppliers, for instance engines and avionics, are associated with one type of plane like Honeywell and Garmin for Learjet production. They did not only produce engines and avionics but share the cost of production of the aircraft.

Business Aircraft	**Engines**	**Avionics**
Lear jet 70 & 75	Honeywell	Garmin (USA)
Global 5000, 5500, 6000 & 6500	Rolls Royce	Bombardier
Global 7500 & 8500	General Electrics	Bombardier
Challenger 300	Honeywell	Rockwell Collins
Challenger 650	General Electrics	Rockwell Collins
Regional Aircraft		
CJR 700, 900 & 1000	General Electrics	Rockwell Collins
Q series	Pratt and Whitney	Thales Systems

Table 4: Suppliers of Bombardier (Bombardier, 2018)

This division of suppliers between different aircraft types also increases management complexity for Bombardier. The different categories of aircrafts that Bombardier manufactures require different suppliers. This leads to an increase in total number of suppliers and consequently to problems in supplier management. Bombardier's extensive supply chain involves thousands of suppliers manufacturing an aircraft, leading to delays in deliveries of product and expensive final product.

Bombardier's two biggest weaknesses during the production of the C-series were a lack of capital and delivery issues in the extended supply chain. At the same time, Bombardier's efforts for the C-series distracted the company from their existing business, leading to increased backlog and losing customer interest to competitors such as COMAC. We can observe that Bombardier's extensive outsourcing was necessary but created unmanageable complexity. It suffered from an extensive list of suppliers, late deliveries, excessive inventory and increasing backlogs.

We suggest that Bombardier's purchasing should focus on deeper integration with the overall goals of the firm, reduce its number of suppliers and focus on improving its technological base.

Already, Bombardier has decided to drastically streamline operations. They have decided to reduce the number of suppliers they are working with from 10,000 supplier to 2,000, an 80% reduction (Jacobs, 2018). Bombardier expects that by reducing the number of suppliers, they will be able to create transparency in purchasing, better define the role of suppliers and reduce cost of operations. The company has also merged the purchasing and supply chain department, as Bombardier believes that merging of these two teams can result in strong performance. These actions will help better align the firm's purchasing strategy with their overall goals.

To reduce the number of suppliers, Bombardier should strongly evaluate what products it can produce in-house or through joint ventures. Improvements in additive manufacturing can make a big difference in this field. The firm should look towards forming strategic relationships with firms that can help improve its own capabilities in this regard. Currently, Bombardier is importing semi-finished fuselage that is made by Stalia Aerospace, a company based in France, which is later completed and assembled by Bombardier. Stalia Aerospace is manufacturing fuselage with the help of additive printing, which is enabling the company to bring down the cost and product time, resulting in timely deliveries. Similarly, Pratt and Whitney produced engines with the help of additive printing which helped them reduce the cost and weight of the product keeping them 15 months ahead of time (Albright, 2015). Additive manufacturing can potentially be a tool to reduce the number of suppliers, inventory cost and cost of transaction, as it can manufacture complete product by itself.

Secondly, the firm should focus on partnering with firms that are willing to take on a greater burden of both financial and managerial responsibilities. The firm's major weaknesses are in the availability of upfront capital and managing an extended supply chain. Suppliers that can help the firm in these tasks are far more useful than ones that excel purely on quality or price terms. Improvements in purchasing terms, such as increasing the period

of credit and moving on inventory management responsibilities to suppliers can also help in freeing up capital for the firm.

A second criterion that can help identify strategically important suppliers is cross applicability. Suppliers that can provide parts for the entire range of aircrafts designed by Bombardier are more important than those with single category offerings. Working with the same supplier on multiple aircrafts can reduce the overall number of suppliers. We can observe that Rolls Royce, Rockwell Collins and General Electric are the suppliers that work on many projects with Bombardier.

Bombardier should also be more wary of suppliers in emerging markets. Currently, in Brazil, Russia, India and China Bombardier has customer service sites, engineering site, propulsion and control production manufacturing sites and in Mexico, Bombardier has components and electrical harnesses production site. The emergence of competitors such as COMAC can be a threat to its business.

We suggest Bombardier to reduce the problem of supply chain, it should reduce the number of suppliers because their experience with C-Series and Q Series did not go well. Bombardier was working with more than 2000 suppliers. Where it managed to share risk with suppliers, multiple sourcing at such huge level led to cost out runs and delays in the delivery of aircrafts by years. This trend has been reviewed in strategies adopted by Boeing and Airbus which are operating in Post Tier 1. We recommend Bombardier to step ahead of Tier 1 approach to Post Tier 1 approach as currently it is following a mixture of two approaches which is not working in its favor.

Once Bombardier is able to select an approach, it is recommended that it should focus on reducing the number of suppliers for which we have suggested couple ideas like re-evaluating the decision of make or buy, use the technology to manufacture complete products which could help to eradicate the role of some supplier, form strategic collaborations with supplier to work closely with them and to emphasize the Tier 1 supplier to manufacture complete products, which could help to reduce costs. We also established that the problem of inventory, high price of final product and delays in delivery are mostly due to extended sourcing and involvement of many suppliers. Once the number of suppliers are reduced, it would increase transparency in supply chain, and diminish or eradicate the margins of suppliers resulting in competitive prices of final product.

5.2.4 Cross Case Analysis

Approach	Company	Models	Suppliers	Sourcing Strategy	Advantages	Disadvantages
Pre Tier 1	Boeing	737		Vertical Integration (subassembly outsourced)	*Control of the production and operations *On schedule deliveries	*Too much risk involved
	Airbus	A320		Vertical Integration (subassembly outsourced)	*Control of the production and operations *On schedule deliveries	*Too much risk involved
Tier 1	Bombardier	C-Series	2000-10000 Multiple suppliers	Outsourcing	*Risk sharing *Development of an efficient aircraft *Fuel efficiency was core selling point	*Delays in deliveries *Accountability issues * Went over budget *Lack of capital
	Boeing	787		Outsourcing	*Risk sharing *Low cost for products manufactured in foreign countries	*Deliveries delayed by years *Quality issues *Increased overall cost (cost outruns).
	Airbus	A380	>200 Tier 1 suppliers	Outsourcing and vertical integration	*Risk sharing *Entered new markets	*Delays in deliveries *Lack of traceability of supplier *Quality issues
Post Tier1	Bombardier	Regional Jets	Reduce number of suppliers	Outsourcing and vertical integration	Has to enter the market in 2022	Has to enter the market in 2022
PFS 1 & PFS 2 (Reduce cost by 15 to 25%)	Boeing	777X	Focus on cost reductions Reduce number of suppliers	Outsourcing and vertical integration (collaboration and focused factories	Has to enter the market in 2019	Has to enter the market in 2019
Scope+ (Reduce cost by 10%)	Airbus	A350	Focus on cost and supplier reduction	Outsourcing and vertical integration (dual sourcing)	*Increased profitability *Transparency in the supply chain	

Table 5: Cross case analysis

The cross-analysis of the three largest players in the aerospace industry illustrates that the companies are customizing the Pre-Tier 1

The Pre Tier 1 approach was a mix of vertical integration and outsourcing. The OEMs were performing the jobs that are now done by Tier 1, Tier 2 and Tier 3 suppliers. The manufacturing of A320 by Airbus is a great example to see how the manufacturing and

assembly of an aircraft took place. The subassembly of certain parts were outsourced to suppliers and OEMs were working in collaboration with them to keep control of the production. Though the Pre-Tier 1 strategy was OEM dominated, it was becoming difficult for the OEMs to be competitive in the market. Global sourcing was a solution to it as it provided low cost resources. This is why Tier 1 approach was accepted so willingly.

When Tier 1 approach was introduced by Bombardier, it was tested with 12 partners that were sharing risk and responsibilities with the company which provided Bombardier time to focus on the operations that could help the company in becoming competitive. Bombardier however never tested as to how many suppliers should be involved in the process of manufacturing to keep it healthy for the company. This was a major setback as all the three companies went in with large number of suppliers for the production of aircraft and extensively outsourced. For instance Bombardier went up to having around 10,000 suppliers for the production of C-Series and Airbus had more than 200 Tier 1 suppliers for A320.

The extensive outsourcing and limited knowledge and testing of Tier 1 approach has led to problems in manufacturing of Bombardiers C-Series, Boeing's 787 and Airbus A380. The extensive number of suppliers involved in the supply chain has resulted in delivery delays, lack of accountability and traceability of supplier which became the reasons for delivery or quality issues. In addition to this, there was reduction of profitability for OEMs. More suppliers resulted in higher price for the OEM as every supplier had their profit margins added up in the final price of the product purchased by OEMs. This along with management and coordination with the supplier added up in the costs, resulting in major cost outruns by each of the three companies.

In Post Tier 1 era, we can observe that the companies are returning back to their old strategies of Pre-Tier 1 era, with some differences like increased role and responsibility for the suppliers. Companies want the involvement of the suppliers especially that hold strategic importance for the company. They are forming collaborations with the supplier to ensure that they can have timely deliveries of quality products. Also, it can be observed that all three companies are interested in reducing the number of supplier they are working with.

In addition to this, the companies are forcing the suppliers to reduce their costs, if they are interested in working with the OEMs. The approach of reducing the suppliers and pressurizing them to reduce cost will make the supplier market more competitive and increase the power of OEMs in the industry. This is the dominance OEMs were enjoying during the Pre-Tier 1 approach. Furthermore, reduction of suppliers will help the OEMs in creating transparency in the supply chain and increase accountability which will help

OEMs to identify underperforming suppliers and take appropriate actions: omit them or invest in them.

As we can study from the table, the companies are interested in outsourcing and vertical integration, it is important to distinguish as to which products should be manufactured through vertical integration and which products should be outsourced, how many suppliers should be part of the production team and what relations should be shared with these suppliers. The next section of the thesis highlights implications for the purchasing managers and answers to how they can develop a resounding purchasing strategy.

5.3 Implications for purchasing managers

After reviewing the competitive state of the aerospace industry and how both suppliers and OEMs are operating in the market, we can suggest some basic guidelines that can help purchasing managers in the aerospace industry. We can begin by first identifying the key goals for OEMs in the industry.

In the previous section we have established that the OEMs have a very competitive and secure position in the industry with regards to both their customers and suppliers. The Porter's Five Forces analysis showed that the threat of entrants is low, as massive amount of capital, a deep research base and extensive process knowledge is required to be successful in the industry. These requisites to enter the industry have resulted in a limited number of OEMs operating in the market. The bargaining power of suppliers is also limited. A relatively large number of suppliers are available in the market, especially at the lower tiers. In addition, suppliers have shown a willingness to upgrade their capabilities to a certain extent in order to become preferred suppliers.

There is also ever-growing demand for new aircrafts which means that there will be plenty of business for OEMs to secure greater revenue. The data from the airline companies show an increase in the number of passengers using air travel. This assures the managers that there is a massive opportunity for growth. In such a scenario, the first focus of the OEMs has to be towards improving the supply chain of the company.

After costs, supply chain delays have been the second biggest issue for OEMs. OEMs have constantly switched strategies in order to improve this aspect of their operation, involving more suppliers in the production process. However, this has not resulted in an expected good performance for OEMs. In fact, in some case, there has been an increase in the lead times of aircraft deliveries by OEMs due to the inability of the suppliers to match the demand of the OEMs and deliver on time. Some OEMs have also reported quality issues with their products.

Having a long supply chain, with many suppliers is a necessity for aircraft manufacturing but also presents major challenges. Managing a supply chain consisting of hundreds of suppliers is bound to lead towards a lack of traceability and diffused responsibility. Thus, the second aim of OEMs should be to streamline supply chain and operations that are necessary for the manufacturing of aircraft to increase transparency.

In addition to this, the Five Forces analysis showed that there is intense rivalry in the industry. The offering by different OEM's are not vastly differentiated and they are actively chasing new business. In addition, we have recognized the need for lighter and more fuel efficient aircrafts as one of the major needs of airlines. Thus, the third aim of OEMs should be to protect their competitive advantage by focusing on new technologies.

Once we have established the three aims of OEMs in the aerospace industry: reducing costs, streamlining operations and protecting competitive advantage by investing in new technology; we can discuss the implications of this for purchasing managers.

Our study indicates that OEMs have alternated between outsourcing and vertical integration strategy interchangeably. In more recent times, the OEMs can be observed using a blend of these strategies together. This combination of outsourcing and vertical integration can be successful if properly aligned with the business goals of the firm. Outsourcing can reduce directs costs of manufacturing and helps OEMs sharpen their focus. It is well suited to products and parts where there is little risk of knowledge spillover. On the other hand, vertical integration is preferable for parts which are more critical and where suppliers need much closer interaction with the OEMs. By insourcing certain production activities, the OEM will be able to take part in the production of the aircraft which currently is very limited. Furthermore, by combining the two strategies, the OEMs could exercise greater control over the supply chain and limit the number of suppliers they are currently engaged with. The reduction in suppliers should be based around the twin goals of reducing costs and decreasing management complexity.

A second consideration when choosing which parts to insource and which to outsource is the internal capability of the OEM. The purchasing managers of the OEMs should therefore evaluate the internal strength of the company and compare them to the external opportunities to identify which products would be profitable if produced in-house. This would require an evaluation of the supply environment for the product and the technological level of suppliers. Our study also highlighted few advanced technologies that can help simplifying the production process.

Technologies such as additive manufacturing and robotic manufacturing can be key when making the decision to insource products as they vastly simplify the production process.

Robotic manufacturing can help OEMs manufacture wings of the aircraft that was initially outsourced to Tier 1 suppliers. Similarly, some jobs previously performed by Tier 2 and Tier 3 suppliers can now be done by additive manufacturing, however the potential of additive manufacturing is yet to be seen. The OEMs have started testing the manufacturing of some parts and components with the help of additive manufacturing. Parts that can be manufactured using these technologies can be insourced much more easily. Government support can also be key in this regard as numerous programs are available to support new research efforts and capacity building.

For products that are necessarily purchased, purchasing managers need to formulate an improved supplier selection criteria. Based on conclusions from our study and the corporate goals we have listed, we suggest that suppliers should be short listed based on their performance on four criteria: price, capacity, technological capability and on time delivery. These criteria are in alignment with the corporate goals we have mentioned as well as the current state of the industry.

Based on our study we showed that there is an increasing demand for new aircraft. Additionally, firms already have huge backlogs of order to fulfill and buyers do not have substitute suppliers or products. There is a massive opportunity for growth. In order to capture this growth, it is important that all suppliers have the capacity to fulfill not just existing demand but also potential increases in the future. Furthermore, they should be able to do so on tight schedules. The technological capability of suppliers is also important since it protects the competitive advantage of the OEMs. OEMs can learn from suppliers that are technologically advanced and integrate these technologies into their own supply chains as well. Thus, it is important to consider this as a criterion separate from basic capacity and price.

Purchasing managers should also seek to form closer collaborations with suppliers that possess some level of technological innovation, whether it is in process or product. Product based innovations, such as those that can reduce the weight of aircrafts or lower fuel consumption, can become a source of competitive advantage. Purchasing managers should seek to create a relationship which leads these suppliers to become dependent on the OEM. Suppliers with process-based innovations, such as robotic manufacturing, can contribute insights to the OEM’s own manufacturing capability as well as being potential targets for vertical integration.

In order to streamline operations, it is imperative for purchasing managers to reduce the number of suppliers that firms deal with. This can be done by means of delegating the responsibility of dealing with lower tier suppliers to tier 1 suppliers. However, this strategy comes with the risk of losing control over their supply chains and has previously led to

both quality and lead time issues. Strategic collaborations, or joint ventures, with strategic tier 1 manufacturers can be useful in these cases.

Joint ventures are recommended for strategic items because they allow OEMs direct access to the manufacturing knowledge of their strategic suppliers as well as the ability to track products in their extended supply chain without necessarily making the up-front investment of vertically integrating the supplier. Vertical integration also poses the risk of losing the expertise, skill and experience that the supplier already has in the field. Buying up suppliers also risks alienating suppliers in the market who want to maintain their independence.

One potential means of integration between suppliers and OEMs that Boeing has put into practice is the concept of focused factories. A focused factory is a manufacturing facility that is dedicated to making a smaller number of products for a single buyer. This creates dependency for the supplier towards the buyer and makes the process easier to manage. Such a factory is not a joint venture or even necessarily an investment from the buyer, yet it can significantly increase the control of the buyer on the supplier. This is one option that OEMs can consider in managing their relationship with strategic suppliers.

Finally purchasing managers should make extra efforts to gain access to emerging markets. Tremendous growth is expected in emerging markets such as Asia Pacific and the Middle East. Suppliers based in those regions can help OEMs gain a stronghold as well as gain access to institutional support in these regions. Partnering with suppliers based in emerging markets can potentially lead to support from local governments. However, there is a caveat to this decision. Emerging markets such as China are also trying to build their own OEMs and any knowledge spillover in such markets can be tantamount to helping potential competitors. Purchasing managers need to consider both the pros and cons of this process before making their decisions.

In this section we have analyzed purchasing strategy in the aerospace industry in general terms. We used information about the state of the industry, its evolution and the factors that affect purchasing strategy to formulate guidelines for OEMs. In addition to these guidelines we suggest a five-step process to formulating an effective purchasing strategy that considers the reality of the aerospace industry and is in alignment with corporate strategy. The five steps of this process are: Re-assess existing sourcing strategy and capabilities, Re-evaluate supplier base, Formulate new strategic direction, Negotiate, Continuous re-evaluation. These steps are explained below:

Step 1: Re-assess existing sourcing strategy and capabilities

The first step for formulating a purchasing strategy is to take stock of the existing status quo and decisions. Even if the firm has not previously considered purchasing to be a strategic function or designed a purchasing strategy, previous sourcing decisions can provide important insight into where the organizations stands.

A re-assessment can begin by reviewing previous purchasing decisions and evaluating their success or failure. There are two important considerations in this regard. Firstly, that the result of the purchasing decision encompasses more than just the initial procurement of goods. The decision needs to be evaluated based on its long-term effects and total cost of ownership. Secondly the purchasing decision needs to be evaluated on more than one criterion. It is important to consider if the product lived up to the organization's expectations at the time, if the price, quality and delivery characteristics match well with industry standards and how well do they align with organizational goals. This process will provide a benchmark oh the firm's purchasing performance.

In addition, this process can allow the firm to recognize both the patterns in its policies and internal weaknesses. For example, if a firm evaluates a single outsourcing decision and finds that there were additional unplanned costs associated with it, it might evaluate that as a supplier issue. On the other hand, if all outsourcing decisions have similar costs associated with them, then the firm needs to reevaluate its outsourcing process.

The reassessment process should also consider industry dynamics. The Porter's Five Forces analysis presented in this study can be an important tool in this regard. It can provide the firm with a good understanding of its position in the market, its relative bargaining position and the needs of its buyers. Purchasing managers also need to have a good idea of the firm's internal competencies.

At the end of this step, purchasing managers should have an idea of what decisions have proved successful, what are the firm's strategic strengths and weakness and how well does the current purchasing strategy align with the corporate strategy of the firm. In the aerospace industry, most companies have prioritized cost reduction as their primary goal. For instance, the vision statement of Bombardier's Aerospace division is focused on enhancing cost structure while seeking opportunities to maximize revenue generation.

Step 2: Re-evaluate the supplier base

Purchasing managers at OEMs also need to understand the needs of the suppliers in order to formulate appropriate relations with them. Additionally, they need to be cognizant

of the capabilities and weaknesses of their suppliers. It is important to recognize suppliers who can contribute to the firm's strategic advantage.

Recognizing supplier capabilities is important for successful relationships between buyers and suppliers. While OEMs have used their stronger bargaining power to continuously push suppliers, this is not a successful long-term strategy. Suppliers increasingly feel that they are continuously pressured to reduce prices and forced to expand their capabilities. Some of the suppliers at tier 2 and 3 are even scared of being replaced by advanced technologies like additive printing and the robotic manufacturing. Such continuous pressures are resulting in production of low-quality products and are impacting the performance of the suppliers. Suppliers are also trying to strengthen their position through mergers which can impact the bargaining position of OEMs.

These concerns make it important for purchasing managers to understand their suppliers better. This evaluation of suppliers should consider a number of dimensions. Price and quality are obviously important to all firms in every business and need to be a part of the supplier evaluation process. Secondly, suppliers need to be evaluated on their delivery performance. In the long supply chains associated with the aerospace industry, late deliveries can have dramatic effects on the rest of the supply chain. Thirdly, suppliers need to be evaluated on the basis of their growth potential. There is significant growth in demand expected in the aerospace industry and OEMs need suppliers that can keep up with this. Suppliers also need to be evaluated on the basis of their technological capabilities. In particular, expertise in additive manufacturing, robotic manufacturing or the production of lighter weight components using composite materials makes suppliers particularly attractive in the industry. Lastly, suppliers need to be evaluated for their process and management capability. Since OEMs are constantly looking to offload management responsibility for lower tiers of the supply chain, a supplier that has the capability to manage these relations is quite attractive. Also, suppliers who have efficient process and managerial systems can be earmarked as potential targets for long term strategic relations and investments into increasing their capabilities.

At the end of this step, purchasing managers should have an idea of the capabilities of their suppliers. Reducing suppliers is a key imperative for OEMs. The worst performing suppliers need to be cut-off and this process should provide a good indication of where that reduction can take place. Purchasing managers should also be able to identify the best performing suppliers and those with the greatest potential to create stronger and more integrated relationships.

Step 3: Formulate new strategic direction

Having evaluated the current market situation and previous purchasing choices as well as the supply base, the next step is to formulate the product specific purchasing strategy. A key component of strategic purchasing is to recognize that the same methods should not be adopted for all suppliers and products. The actual strategy should address the needs and market situation of the specific produce being procured. Analytical tools can be a great help for firms in this process. The matrices designed by Kraljic and Cousin can assist the purchasing managers in formulating appropriate product specific strategies.

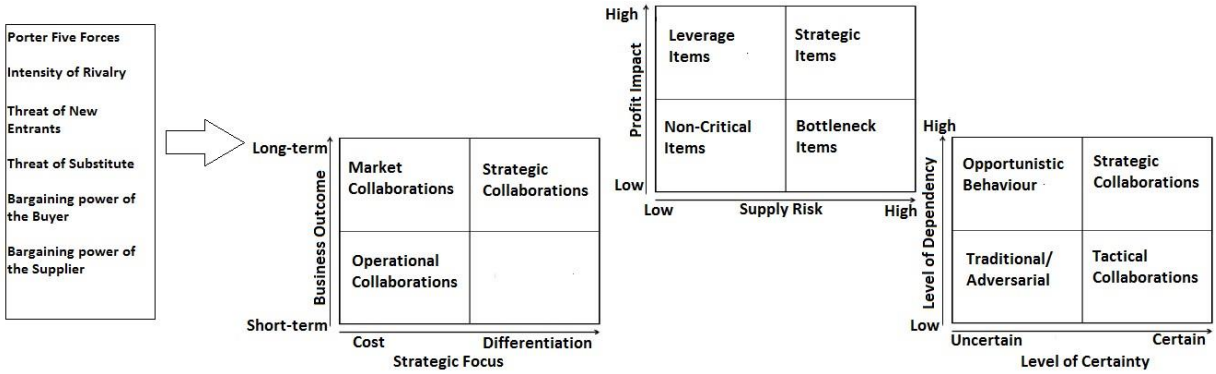

Figure 14: Strategy Formation Model

In pursuance to formulate a resounding strategy, the purchasing managers are suggested to scan their external and internal environment of the industry. Porter Five Force Model can be a useful tool to do so as it help in picturing the interactions between buyer and suppliers in the industry, the strategy that is adopted by the supplier and its customer, competition in the industry, threats posed by substitutes, rivalry in the industry and threat of new entrant. Once the purchasing managers are aware of the power and weakness of the stakeholders in the industry, they are suggested to use Kraljic model to divide their products and develop appropriate strategy that meets the need of buyers and suppliers.

It is suggested that the managers should focus first on distinguishing their strategic items from the non-strategic ones. The Kraljic matrix could assist in evaluating the impact on the profitability and the supply risk that is posed to the business. For instance, for OEMs products like wings, engines, cockpit control stimulators are some of the strategic items that are core for the aircraft production and have the greatest effect on profitability.

Once the OEMs can distinguish between items, they need to combine the insights from the previous two steps, Porter Five Force analysis, along with this categorization of

products, to formulate their strategy. Purchasing managers along with the other departments have to unanimously decide on “make or buy” (vertical integration or outsourcing) decision. If the firm has the internal capability to produce a product that falls in any four quadrants, they would have to decide whether it is advantageous to move towards vertical integration or to outsource.

Vertical integration can take place both through buying out the particular underperforming supplier as well as starting off production internally from scratch. However if the firm does not possess the capability to produce in-house, then the purchasing managers should look for their options to outsource the product. This process will help the purchasing managers to eliminate the chances of underutilizing the resources and capabilities of firm and give a clear picture of which items of the Kraljic matrix need the external intervention.

Once the purchasing managers are aware of their products that need to be outsourced, purchasing managers then have to decide the sourcing strategy, the outcome of the sourcing and the type of relations they expect to form with the suppliers. The sourcing strategy could vary between multiple, dual or single and global or domestic sourcing.

Non-critical are standardized low value products that are readily available in the market, can be outsourced easily and require much less intensive relationships. As the products are readily available in a competitive market, there is very small chance of improving business performance and increasing profitability. For non-critical items, the firms should focus on forming operational collaborations that would result in traditional relations with the suppliers. Firms should look to outsource not only the production of these items but also the management of their procurement.

On the other hand, bottleneck items can have a strong positive or negative impact on the business performance. Therefore the purchasing managers should be careful when formulating the purchasing strategy and should consider the challenges they might face for the bottleneck items. For bottleneck items, the supply risk is high and the impact on profitability is low hence it cannot be justified to make a large investment in the supplier’s capabilities. . It is suggested, that the firms should focus on tactical collaborations for such items where both buyers and suppliers might form short-term collaborations in order to achieve business objectives. Such collaborations can help in eliminating the supply risks. If the supplier has a positive evaluation, then it would make sense to move towards focused factories. Focused factories can help the firms to collaborate or merge with suppliers that would be interested in dedicating their production solely to the firm.

Leverage items though have low supply risk, these items have a huge impact on the overall performance of the business as impact on profitability is high. Besides the fact that

the market of leverage items is extremely competitive due to the presence of many firms offering similar product at similar prices, a strong purchasing strategy can help the firm to stand out in competition. For leverage items, firms should focus on market collaborations which could result in opportunistic behavior where supplier can be changed based on their performance and need. Firms can use multiple sourcing for leverage items to create competition between suppliers and gain the greatest reduction in prices. Competitive bidding and targeted pricing can be used to find the most suitable supplier.

Strategic items when compared to other quadrants of the Kraljic matrix, has a high impact on both the profitability of the business and the supply risk. In addition to this, strategic items require large amounts of investments because of which the impact of such products could be long termed. Developing a purchasing strategy in accordance to strategic items is very important as it can impact the overall performance of the business. Therefore, we suggest strategic collaboration strategy, for strategic items. Strategic collaborations require high level of certainty in the internal and external environment as there is knowledge and technology exchange involved and buyer and supplier are collaboratively developing the products. The outcome of the investment in strategic items can be observed in long run and the focus of these products is differentiation. Ultimately, in pursuance to achieve strategic focused outcome of strategic items, firms are suggested to form strategic collaboration according to the SFOM and SRPM.

Once the purchasing managers are aware of their strategic items, they need to review the Step 2 and Porter Five Force analysis to formulate an action plan that is constructed in accordance with the power and influence of suppliers, buyers and competition in the market. Also, in order to enhance the business performance it is essential that the final action plan drawn by the purchasing managers is in alignment with the corporate strategy so that the overall business objective can be achieved.

Step 4: Negotiate with the suppliers

Once the purchasing managers of the OEM have formulated a strategy, it is vital for them to deliver the strategy to their suppliers and negotiate the terms according to their requirements. In order to negotiate the terms with the suppliers, the purchasing managers should be aware of what they desire to achieve and how could they make the suppliers agree to their expected response. Purchasing managers also need to be aware of the importance of the supplier and their past performance.

In case of aerospace, the OEM expect the suppliers to provide lowest possible price products, meet deadlines, reduce the weight of the manufactured product, expand their capacity to entertain more orders and share development risks. It is recommended to the

purchasing managers of the OEM, that they should clearly narrate their requirements to the supplier. It is also important for OEMs to show their suppliers, how important they are for the company. Longer term contracts, agreed volumes, joint investments, involvement in planning and design as well as sharing of process knowledge are some of the key ways in which OEMs can demonstrate this.

Finally, it is also important for OEMs to convey their future strategic direction to their chosen suppliers. Constantly adding new demands can weaken the relationship between buyers and suppliers. If an OEM expects to move towards significant cost cutting in the future or expects a big upswing in demand, it is beneficial to let their suppliers know in advance.

Step 5: Continuous Reevaluation and Improvement

Once the purchasing strategy is established, it needs to be continuously re-evaluated. Purchasing managers need to check if the strategy is working in harmony with all the functions of the business and is aligned towards achieving the expected outcome. Also, managers should keep themselves updated with changes in their environment so that the strategy could be updated if there is a significant change in internal or external factors.

The OEM should take advantage from the advancements in the technology and should continuously invest in formulating analytical tools that could help them in measuring performance of the purchasing function. This will help them in accommodating the required changes immediately and help them stay ahead in the competitive industry.

Below is a graphical representation of the five steps discussed in this section.

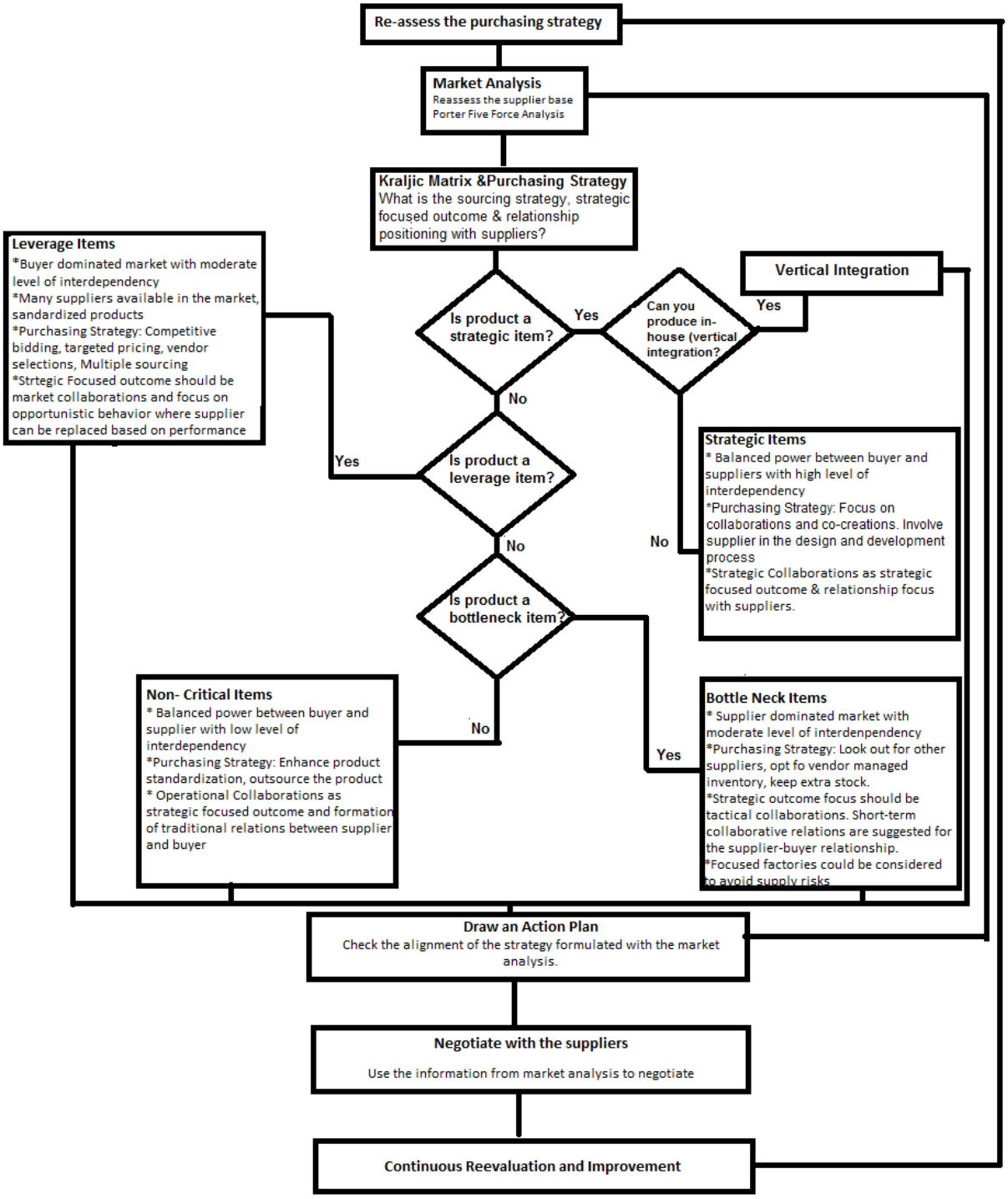

Figure 15: Flowchart for Purchasing Decision Making

Conclusion

The global aerospace industry is unique due to the incredibly complex and expensive process of manufacturing aircrafts. It requires massive upfront capital costs, years' worth of research effort and above all the management of a supply chain that includes thousands of suppliers across multiple tiers supplying millions of components. The management of such a complex supply chain makes the purchasing strategy of aircraft manufacturers extremely important and an important subject of study for researchers in purchasing.

In this thesis, we have used data from secondary sources to study purchasing strategy and its evolution in the aerospace industry. Additionally, we have used this data to suggest implications for purchasing managers and designed a framework to formulate purchasing strategy.

In the first chapter, we discussed the definition and scope of purchasing strategy as well as some of its key aspects. While purchasing is often practiced as a routine or tactical function, we demonstrated that recognition of its strategic importance can help firms create competitive advantage through effective purchasing. Recognition of purchasing as strategically important requires the use of analytical tools such as the Kraljic matrix, deeper understanding of crucial sourcing decisions, evaluating suppliers based on the right criteria and effective management of the buyer-supplier relationship. Finally, successful purchasing strategy needs to be in alignment with the firm's overall corporate objectives. These dimensions were discussed in the first chapter using the available academic literature.

In the second chapter we provided an overview of the aerospace industry and discussed its structure with respect to purchasing. The industry has two separate and distinct sectors. The commercial sector consists of aircrafts made for commercial airlines and private customers and is dominated by a handful of OEMs. This sector has been seeing continued increase in demand which is expected to grow even further in the future. On the other hand, the defense sector depends on government procurement for security needs. The commercial aerospace sector has a tiered structure of suppliers. Each tier of suppliers supply aircraft components to the tier above, who assemble it into a higher level part that is supplier to the tier above. This tier based structure is managed by the OEMs, who assemble the final aircraft. The second chapter also discussed the state of the aerospace and the development of purchasing strategy in the industry.

Our discussion in the second chapter showed that there is healthy growth expected for the global aerospace industry. Purchasing in the aerospace industry has evolved from an

entirely vertically integrated structure, to highly outsourced structure and is now shifting back towards vertical integration. OEMs are trying to reduce their risk exposure by handing over more increased responsibilities to their Tier 1 suppliers. This process has increased collaboration between OEMs and their suppliers as well as creating greater dependency on these strategic suppliers. However, this process has not seen uniform success for all companies and firms such as Boeing are looking to move back towards vertical integration. OEMs are also increasingly trying to reduce the number of suppliers they deal with and pushing their existing suppliers to reduce costs. In retaliation, some suppliers have merged creating new 'super suppliers' that have a much stronger bargaining position.

In the third chapter of our study, we discussed the different factors that are impacting purchasing strategy. We identified globalization, emerging countries, technological advancements, prime customers of the aerospace industry, oil price fluctuations, exchange rate fluctuations, environmental concerns and institutions as the major factors affecting purchasing in the aerospace industry. Globalization, and the fast growth in emerging markets, has allowed OEMs greater access to new customers, suppliers and purchasing strategies. Initially firms sought outsourcing as a solution to reducing costs and risks, however, in what has been referred to as the second phase of globalization, firms are focusing on reducing complexity and forming joint ventures with suppliers. Some emerging markets are also aggressively building local aerospace industries which can be a challenge for existing OEMs in the future. Technological advancements and environmental concerns are placing pressures on purchasing managers to seek out lighter aircraft components. Additionally, the emergence of additive manufacturing has reduced manufacturing complexity allowing OEMs to build more parts in house. These factors are expected to become even more important in the years to come. We also showed that the aerospace industry is strongly affected by changes in economic patters, especially the price of oil and currency exchange rate fluctuations. Lastly, institutional support is important for the sector. Governments seek to support their local aerospace industries through both tax measures and funding for research.

In the next chapter we have used this data to analyze purchasing strategy and provide recommendations. In the first part we used Porter's Five Forces analysis to analyze the competitive state of the industry. This analysis can help an OEM understand its relative position when negotiating with suppliers and formulating their purchasing strategy. Using the analysis, it was shown that there is a low threat of entrants in the aerospace industry and a low to medium threat of substitute products and services. The OEMs have strong bargaining power compared to their suppliers, however this is changing as new strategic relationships make OEMs more dependent on strategic suppliers. In terms of bargaining power, the supply base be differentiated between strategic suppliers and the rest. All of

this leads to intense competitive rivalry in the industry. This was followed by a cross case analysis of the three largest companies in the aerospace industry. Based on Porter Five Forces and cross case analysis we suggested formulated implications for purchasing managers in their purchasing decisions.

We suggest that reducing costs, streamlining the supply chain and improving technological capabilities should be the primary aims of the OEMs' purchasing strategy. All purchasing decisions should be in alignment with these goals. The combination of vertical integration and outsourcing can be successful for OEMs if purchasing managers choose the respective items for these activities in consideration of overall firm strategy. Purchasing managers need to be well aware of the internal capabilities of the firm and look to add to these capabilities through close interaction with strategic suppliers. It is suggested that apart from price, new suppliers should be evaluated on their capacity to grow, technological capabilities and on time deliveries. In addition to these recommendations we also recommended a five-step process that can help in formulating purchasing strategy. The five steps of the process include re-assessing existing sourcing strategy and capabilities, re-evaluating supplier base, formulating new strategic direction, Negotiating and Continuous re-evaluation.

Limitations and Future Research Prospects

The research conducted to evaluate the evolution of the purchasing strategy in the aerospace industry is based on secondary data. The theoretical chapters were constructed with help of the research papers that were published in reference to purchasing strategy and aerospace industry. Whereas the data and the other relevant information was collected from newspapers, annual published reports and analysis reports by companies like PwC and Deloitte. The paper does not include any first-hand collected data or information.

Also this paper is written in accordance to the purchasing strategy of the aerospace industry in particular. Where the thesis does present the perspective of the suppliers, the implications are specific to the purchasing managers of the OEM operating in the aerospace industry and therefore cannot be generalized. Consequently, there is still plenty of room for further research in this field.

The dynamic environment of the industry has led the OEM to adopt a set of different purchasing strategies like insourcing and outsourcing for the production of different aircrafts to achieve the same purpose which is cost reduction. In future it is suggested that the researchers should cross-examine the impact of each of the sourcing strategy adopted by the OEMs on the purchasing functions to identify the best suit for the aerospace industry.

Also during this research, eight factors were identified that had an impact on the purchasing strategy of the aerospace industry. These factors were identified with the help of secondary research. However, there is scope of further research on the measurement of the impact of each of these factors on the purchasing strategy with the help of primary data collection methods like interviews or surveys.

The trends discussed in the thesis also indicate a possibility of reversal of globalization. The advancements in the technology and the introduction of robotic machinery and additive printing is eliminating the role and need of the suppliers. For instance, Boeing is manufacturing the wings with the help of robotic manufacturing. Under such technological advancements, the role of supplier is put in to question. Therefore it is suggested that the researchers should study to determine the threat that technological advancement pose to the position of suppliers in the aerospace industry.

Lastly, it is also suggested that the researchers should identify the impact of purchasing strategy on the corporate strategy especially when it comes to the aerospace industry.

This will help the researcher to identify which purchasing functions are influential in formulating the corporate objectives and enhancing the performance of the business.

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