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Supplier Development Initiatives in the Aerospace Industry

By

Amne Samhat

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Abstract

Supplier Development (SD) has been thoroughly and increasingly utilized in practice and researched in academia. Many studies show the importance of SD in improving performance and competitiveness of both the buying company and the supplier, but very few have researched the implementation of SD initiatives in the aerospace industry. This thesis aims to fulfill several purposes. First, I identify the success factors for SD initiatives in the aerospace industry using a comprehensive review of the literature. These include supplier development factors, knowledge management enablers, and specific industry features. Second, I assess and compare five SD initiatives implemented in three provinces of Canada, in Mexico, and in the United Kingdom. Lastly, I present several recommendations that should benefit the successful implementation of SD initiatives in the aerospace industry. Two main research methodologies are utilized to achieve these purposes: documentary analysis and semi-structured interviews. In general the results show the existence of two types of SD initiatives and identify trade associations as critical players in managing these initiatives. The assessment of the initiatives reveals that success factors are present in strategic initiatives rather than in reactive ones. The comparison of the factors of the initiatives allows the identification of several findings. For example, the initiatives that evaluate suppliers using less rather than more processes were found to be more efficient, and the use of relationship management guidelines is imperative in promoting knowledge management activities within the initiative.

Keyword: Supplier Development, Knowledge Management, Aerospace Industry, and Clusters.

Résumé

Le développement des fournisseurs (DF) est de plus en plus utilisé dans la pratique et étudié dans le monde académique. Beaucoup d`études montrent l`importance du DF pour améliorer la performance et la compétitivité de l`acheteur et du fournisseur, mais peu d'études s'intéressent aux initiatives de DF dans l`industrie aérospatiale. Cette thèse aspire à remplir plusieurs objectifs. Premièrement, nous identifions les éléments de succès des initiatives de DF de l'industrie aérospatiale à partir d'une revue exhaustive de la littérature. Ces dernières comprennent des aspects de DF, des facilitateurs de la gestion des connaissances, et des éléments spécifiques à l`industrie. Deuxièmement, nous évaluons et comparons cinq initiatives implémentées dans trois provinces du Canada, au Mexique, et au Royaume-Uni. Finalement, nous présentons plusieurs recommandations s'adressant aux organismes responsables des initiatives de DF dans l`industrie aérospatiale. Nous avons utilisé l'analyse documentaire et les entrevues semi-structurées comme méthodologie de recherche. Les résultats montrent l'existence de deux types d'initiatives de DF, réactive et stratégique, et identifient les associations commerciales comme des intervenants critiques qui contrôlent ces initiatives. La comparaison des initiatives permet de conclure que les initiatives qui évaluaient les fournisseurs avec moins de processus sont plus efficaces et que l`utilisation de guides de gestion de la relation est essentielle pour favoriser les activités de gestion des connaissances.

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List of Abbreviations

AIAC: Aerospace Industry Association of Canada

CSIP: Continuous Sustainable improvement Plan

GDP: Gross Domestic Product

KCT: Knowledge Chain Theory

KM: Knowledge Management

MRO: Maintenance Repair and Overhaul

OEMs: Original Equipment Manufacturers

R&D: Research and Development

SD: Supplier Development

SMEs: Small and Medium Enterprises

UNDP: United Nations Development Program

RELEX: Relationship Excellence

RTA: Regional Trade Associations

NATEP: National aerospace technological program

MAA: Manitoba Aerospace Association

CESD: Competitive Edge Supplier Development

MAHRC: Manitoba Aerospace Human Resource Council

SBP: Strategic Business Process

EELA: Executive Edge Leadership Academy

OAC: Ontario Aerospace Council

FEMIA: Federacion Mexicana de la Industria Aeroespacial

SDP: Supplier Development Program

PDP: Programma De Desarrollo De Proveedores

PDQ: Performance, Development and Quality

NADCAP: National Aerospace and Defense Contractors Accreditation Program

SA2GE: Aeronautical Systems for the Environment

IRAP: Industrial Research Assistance Program Funded by Government of Canada

SRED: Scientific Research and Experimental Development Tax Incentive Program

DAG: Defence Acquisition Guide

CRIAQ: Consortium for Research And Innovation In Aerospace In Québec

CARIC: The Consortium for Aerospace Research And Innovation In Canada

AQA: Association of Quebec Aerospace

NSDP: National Supplier Development Program

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1 Introduction

As the business environment becomes more challenging and global, the goal of increasing competitiveness in the aerospace industry has turned out to be very difficult. Given the fact that the aeronautical sector is driven by competition, globalization, turbulent markets, rapid technological changes and the need for a highly knowledgeable workforce (The Aerospace Review, 2012), the regular need for developing suppliers and enhancing the flow of knowledge between the buyer and the supplier leads to the extensive use of SD programs (Chen, Ellis & Holsapple, 2015; Nagati & Rebolledo, 2013). Supplier Development (SD) is defined by Krause and Ellram (1997) as "any effort of a buying firm with its supplier(s) to increase the performance and/or capabilities of the supplier and meet the buying firm's short-and/or long term supply need" (p.21). SD is said to "improve a firm's competitive positions through lowering costs, increasing quality and flexibility, improving technology and reducing cycle time" (Scannell, Vickery & Dorge, 2000, 26). SD programs are found to have a positive impact on suppliers' performance as well as being a vehicle to the increased competitiveness of the entire supply chain (Nagati & Rebolledo, 2013; Krause, Handfield & Tyler, 2007; Hartley & Choi, 1996). These programs are used in different sectors such as automobile, manufacturing, agriculture and others (Hahn, Watts & Kim, 1989; Hines, 1994; Monczka, Trent & Callahan, 1993; Arraiz, Henriquez & Stucchi, 2013). The literature has indicated the existence of several factors that are critical to the success of SD programs.

SD has been at the core of management activities in the aerospace industry because of its significance in developing the aeronautical supply base capabilities and skills leading to long term growth and vitality of the aerospace sector (The aerospace review, 2012b). Enhancing

knowledge management in the SD program facilitates continuous improvement in performance and capability (Chen et al., 2015). In fact, the literature on supplier development recommends the use of several knowledge enablers (Nagati & Rebolledo, 2013).

Aeronautical companies have started to privately fund SD programs in hopes of developing and improving suppliers' practices and performance (Reed & Walsh, 2002). On their end, the suppliers' ability to compete globally and attract prime companies require a range of skills and capabilities including design, manufacture, technology, and innovation capabilities to be improved and developed continuously. All these factors have led to the extensive use of supplier development programs by aerospace companies in order to help upgrade the all-round capability of their suppliers (Brown, 2000). While some research has been done on these programs (e.g. Reed & Walsh, 2002), much less has been done regarding the publicly funded Supplier Development Initiatives (SD initiatives). These initiatives have been implemented in the aeronautical field in different countries (Canada, United Kingdom, France, Germany, and Mexico) in hope of capturing significant global market share (The aerospace review, 2012a). As such, this thesis focuses on SD initiatives specifically.

In the aerospace industry, a review of the literature indicates that several main features play a decisive role in the success of SD initiatives. First, technological and innovation capability is an important feature that SD initiatives should focus on in order to attain a high level of improvement and success in aeronautical products (Reed & Walsh, 2002). Second, market coverage is a feature that should be considered in the SD initiatives because suppliers need to have an access to a greater number of Original Equipment Manufacturers (OEMs) to be able to sell their products and market their aeronautical subsystems and subassemblies (Dostaler, 2013). Third, the level of governmental funding is important in supporting the implementation of the

SD initiatives and providing SMEs with the resources they need to improve their overall processes (The aerospace review, 2012a). Last, the formation of company clusters in the aerospace industry plays a very important role in increasing the productivity of the participating firms and improving their capacity for innovation and growth (Porter, 2000). Thus, clusters also contribute in the diffusion of knowledge, technological and market information for small firms (Niosi & Zhegu, 2005).

This thesis has three main purposes. The first is to identify the success factors for SD initiatives in the aerospace industry. These success factors are related to: SD factors, knowledge management enablers, and specific features of the aerospace industry. The second is to assess and compare several supplier development initiatives depending on the identified SD success factors. The third purpose is to provide several recommendations for the effective implementation of SD initiative based on the comparison of existing ones.

The findings of this thesis are valuable for researchers, practitioners, policy makers, and governments. The aerospace sector is among the few that are considered by governments to be strategic in nature (Dostaler, 2013). Scant research has been conducted on supplier development factors, knowledge management elements, and the success features of SD initiatives in this industry. One reason might be the fact that SD in this field is a sensitive and complex topic that must be considered and analyzed from all angles. Academia undertakes several research topics but studies utilizing implemented SD initiatives in this industry are lacking. Moreover, this study contributes to managerial practice by showing how SD initiatives can be more successful and by providing practitioners with a realistic framework for implementing them effectively. Currently, the expected benefits from SD initiatives are not well understood from all the players in the industry (Mohanty, Gahan& Choudhury, 2014). One of the main reasons is that they lack a

comprehensive understanding of how SD initiatives work and what specific elements are critical for the success of these initiatives. Thus a comprehensive assessment and comparison of SD initiatives should be of great value to all stackholders in the aerospace industry.

In order to provide an extensive background on SD, the next chapter first reviews the definitions, types, processes, and the success factors of SD initiatives. Chapter 3 reviews the importance of knowledge management enablers in the success of the SD initiative. Then, chapter 4 contains a review of the structure and challenges of the aerospace industry as well as the significance of SD in the aerospace industry. This chapter includes also an explanation of the most important aeronautical features that should be considered in SD initiatives. In chapter 5, the two methods documentary analysis and semi-structured interviews are explained as well as the lists of the five initiatives and the interviewees names involved in this thesis. Chapter 6 includes the assessment of five initiatives depending on success factors identified in the literature review using documentary analysis. Chapter 7 contains the comparison between these five initiatives as well as the results and discussion supported by the opinions of the interviewees, and in the final chapter, recommendations and general conclusion.

2 Supplier Development

Rationalization, outsourcing, technological development, tough competitors, and the product's short life cycle all put pressure on corporate management in general and purchasing management in particular, to reassess its current strategies regarding the suppliers' capabilities and performance. Suppliers are expected to continuously improve their performance since they are responsible for providing the customer with a product of high quality, reasonable cost, and within a reasonable timeframe (Hahn, Watts & Kim 1990). The trend of outsourcing forces OEMs to focus on their core competencies, which in turn results in them becoming more dependent on their supplier's capabilities and performance (Abdullah & Maharjan, 2003).

Supplier development programs are found to improve various suppliers' capabilities which directly affect the client's competitive advantage (Hahn et al., 1990, Nagati & Rebolledo, 2012). The concept of SD has been defined in different but complementary ways. For example, Leenders (1966) defined SD as "efforts by manufactures to increase the number of viable suppliers and improve supplier performance" (p.49). Later, Hahn et al. (1990) defined this construct as "any systematic organizational effort to create and maintain a network of competent suppliers" (p.3). Here we adopt the more recent definition by Krause, Handfield & Scannell (1998) who defined SD as "any effort of industrial buying firms to improve the performance and capabilities of its suppliers" (p. 40).

2.1 Direct and Indirect Supplier Development

The literature identifies two types of SD: direct and indirect (Krause, 1997; Hines, 1994; Krause, Scannell & Calantone, 2000). About indirect process, Wagner (2006) states that "the

buying firm commits no or only limited resources to a specific supplier. There is no active involvement of the buying firm in the suppliers operations, and know-how transferred from the buying firm does occur" (p.687). These kinds of development programs could consist of assessments performed for suppliers across regular time periods to assure current or future benefits. Depending on the supplier's performance, the client will either remain committed to one supplier or switch to using several competing suppliers in the hope that this competition will lead to self-development and improvement. This is an enforced competition with no commitment on behalf of the buying firm (Krause, 1997). On the other hand, Wagner (2006) defines direct SD as the "provision of equipment or capital, onsite consultation, education and training programs, temporary personal transfer, inviting supplier personnel, taken as a whole the transfer of knowledge and qualification to the supplier organization" (p. 688). This kind of SD requires time and financial investment by the client. Krause (1997) explained that direct firm involvement in an SD program exists when the buying firm is willing to invest resources and personnel in the suppliers' firm. In this case, the commitment and interaction between the two firms plays a very important role in the success of the SD program and the performance improvement of both the buying firm and the supplier.

2.2 Strategic and Reactive Supplier Development

Hahn et al. (1990) in their article "The supplier development program: a conceptual model" present an SD model and differentiate between the narrow perspective of the SD program which is more passive and periodic, and the broad perspective of the SD program which is proactive and strategic. In their seminal article "An empirical investigation of SD: reactive and strategic processes", Krause et al. (1998) identify two kinds of supplier development activities, which are

reactive and strategic efforts. The authors conclude that reactive efforts are done by the buying firm for different reasons such as: complaints from customers of the buying firm, defects in quality, short-term improvement, and production troubles. These efforts are less systematic and are not based on continuous evaluation and assessment of suppliers. On the other hand, strategic efforts are more systematic than reactive ones and depend more on continuous improvements of the suppliers' capability and performance. This type of developmental process relies on investing more resources in the relationship with the supplier, integrating the supplier in buying company operations, and collaborating with the supplier.

2.3 Supplier Development Factors

Researches on SD have identified several factors that are important to build a successful and effective SD programs and initiatives (Hahn et al., 1990; Humphreys et al., 2004; Krause & Ellram, 1997; Krause et al., 1998). For example, Krause et al. (1998) identified eight factors related to successful SD initiatives after conducting a survey questionnaire with 210 members of the global procurement and supply chain electronic benchmarking network initiative at Michigan state university (GEBN). This research corroborates previous works that have identified the same factors needed for effective SD initiatives.

2.3.1 Top management involvement

Top management can identify SD programs aiming at competition in the marketplace (Hahn et al., 1990). Achieving top management support in such programs is very important for the success of SD activities and efforts (Hines, 1994). Thus, SD programs should be considered by the top management as a part of the company's strategies and plans.

2.3.2 Supplier identification

Identifying suppliers for SD programs is very important. Formal process and meeting with commodity managers helps in identifying critical suppliers who will oversee improvements in aspects as cost, quality, and delivery (Krause et al., 1998).

2.3.3 Cross-functional involvement

In implementing a strategic SD program, the company needs to make sure personnel from various departments of the company are involved (Hines, 1994). The formation of cross-functional teams is important for the success of SD programs since it will contain people who are responsible for understanding supplier's needs (Hahn et al., 1990). Hence, cross-functional teams are supposed to ensure the suppliers understanding of the buying firm demands and requirements.

2.3.4 Supplier evaluation

Supplier evaluation is an important tool not only for selecting suppliers but also for identifying the areas that need development and improvement (Krause & Ellram, 1997). Identifying areas for improvement looks at total cost improvement management, targeted quality, and improvement benchmarks (Krause et al., 1998). Thus, supplier evaluation is a tool that could be very effective in identifying the areas for improvement (Hahn et al., 1990).

2.3.5 Performance measurements

A formal system to measure supplier improvement in cost, quality, delivery, innovation and technology in addition to continuous assessments of the supplier's capabilities should be implemented (Krause et al., 1998). Measuring participant's performance should be conducted

since it is considered a very important element for SD programs that help identify which activities owners of the programs should focus on more (Krause & Ellram, 1997)

2.3.6 Implementation

Direct involvement in SD programs needs a well-built implementation for the activities of SD. The most important activities are: site visits, training/education, inviting supplier personnel, cost and quality improvement sessions, and direct investment in supplier facilities (Krause, 1997; Krause et al., 1998). The success of such activities should depend on trust, communication, and collaboration (Galt & Dale, 1991; Nagati & Rebolledo, 2012).

2.3.7 Continuous improvement

After the implementation of the SD program activities and processes, the owner of the program should follow up on the level of improvement of suppliers over time (Krause et al., 1998). For high-tech industries where buying firms focus on improving the capability of the supplier, continuous improvement is considered one of the most important factors that affect the success of the program.

2.3.8 Length of the initiative

Long-term programs are considered to be more effective than short ones if the buying firms are seeking to improve capabilities and not only performance. The supplier development program is more effective in mature relationships where the two parties are closer and have a high level of understanding which lead to more effective results of the SD program (Wagner, 2011).

2.4 Conclusion

The eight factors identified above will be used in comparing the five SD initiatives in my sample. However, a comprehensive comparison between the SD initiatives should also include that of the various Knowledge Management (KM) enablers in each initiative. The following chapter deals with KM enablers and their importance in the effective implementation of SD initiatives.

3 Knowledge Management in Supplier Development

This chapter starts by discussing the concept of Knowledge Management (KM) and how activities that influence the transfer of knowledge can influence SD initiatives. We then uncover several enablers that are critical for partners to perform more effective KM activities and thus ensure the success of SD initiatives.

Bock, Kankanhalli &Sharma (2006) defined KM as "*structured activities aimed at improving an organization's capacity to acquire, share, and use knowledge in ways that enhance its survival and success*" (p.357). Knowledge Chain theory (KCT) identifies two order KM activities organizations can use to attain better performance. The first order or primary activities according to KCT are meant to assist organizations in gaining and transforming external knowledge. The second order or secondary activities are used by management to ensure the right utilization of the knowledge acquired from the external sources (Holsapple & Singh, 2001; Tseng, 2009). The flow of information or knowledge in a supply chain is perceived to be of higher priority than product flow (Cook, Chung & Holsapple , 1995). Since the knowledge acquired through external relationships is more significant to the development of new capabilities than internal knowledge exchanges (Arroyo-Lopez, Holmen & DeBoer, 2012), supplier development depends heavily on primary KM activities of buyers and suppliers. The usage of these primary KM activities that include knowledge acquisition, selection, generation, assimilation, and emission, enhances the transfer of knowledge between the buying company and its suppliers which in turn facilitates the suppliers' continuous performance and/or capability improvement (Chen et al., 2015). As such, the main purpose of any SD program should be to improve these primary KM activities (Giannakis , 2008).

Aerospace industry is a knowledge-intensive industry due to high investments in innovation and research and development (Niosi & Zhegu, 2005). The success of companies in this industry depends on their ability to create and acquire a large amount of knowledge from their partners. In the aerospace supply chain, knowledge flows in all directions between Original Equipment Manufacturers (OEMs) and suppliers for the successful development and production of the final product (Alfonso Gil & Vazquez Baquero, 2010). For example, the exchange of knowledge in design activities is a difficult challenge and can be achieved only by collaboration with industry partners (Fan, Russell & Lunn, 2000). In a Canadian aerospace study done by Dostaler (2013), the author found that knowledge transfer is an important factor that suppliers should value in order to compete globally. As such, enhancing the primary KM activities of small and medium sized enterprises (SMEs) is important for companies operating in high-tech environments such as the aerospace industry (Kraaijenbrink, Schröder & Wijnhov, 2006).

3.1 Knowledge management enablers

An in depth review of the literature on KM lead to the identification of seven enablers that are important in the promotion of primary KM activities thus leading to more effective SD initiatives.

3.1.1 Relational capital

Relationalism is considered by some to be the most important factor that enables knowledge transfer in the aerospace industry (Rebolledo & Nollet, 2011). Relationalism is a construct used to summarize the most important relational capital variables and includes trust, collaboration, socialization and information sharing (Noordewier, John, & Nevin, 1990; Rebolledo & Nollet, 2011). A case in point is Boeing rating collaboration with suppliers as a crucial enabler for

improving performance capabilities within its supply chain (O'Chareon & Bispham, 2015). These enablers increase inter-firm learning (Rebolledo & Nollet, 2011) and thus boost knowledge management activities such as emission and acquisition of information allowing for more successful SD initiatives. The high technological demands of the aerospace industry heighten the need for better relational capital. For example, collaboration has been argued to be a strategic tool for aerospace OEMs and suppliers (Aerospace supplier programme, 2004) at different Tiers in the supply chain (The aerospace review, 2012a). Communication, which is highly influenced by trust, has also been shown to be a key element that affects the transfer of technological and technical capabilities in this field (Reed & Walsh, 2002). As such, the relational capital of the participants in SD initiatives should be studied if one wants to better judge the success of the KM activities.

3.1.2 Asset specificity

Asset specificity is seen as "transferability of the assets that support a given transaction" (Williamson, 1985, p.95). Assets that are high on specificity are of value in a specific exchange relation but not outside it (Rindfleisch & Heide, 1997). Specificity can be a characteristic of the site, the human assets, the dedicated assets, the physical assets, and the brand name (Williamson, 1979). When it comes to KM, asset specificity should enhance KM activities because they signal the suppliers that buyers are not behaving opportunistically but are truly invested in the relation (Rebolledo and Nollet, 2011). As such, a relationship marked by the investment of highly specific assets should motivate suppliers to assimilate and actively acquire new knowledge and innovate and create new products for their customers (Humphreys, Li & Chan, 2004). Therefore, SD initiatives characterized by the investment of assets with higher specificity should be more successful.

3.1.3 Distance and cultural proximity

In a study in the French aerospace industry, Levy and Talbot (2015) argued that the increase in geographic and organizational proximity (closeness) will in turn increase joint objectives, evaluation systems, standardized procedures, trust, shared standards, and values and beliefs. As such geographical and organizational proximity are two other elements that should affect KM activities and in turn influence SD initiative success.

3.1.4 Formal learning and teaching

SD owners should actively organize special workshops and training classrooms for their suppliers. SD training sessions could revolve around supplier operations support (e.g. teaching advanced techniques such as six sigma and lean management), supplier e-commerce development (e.g. ensuring that suppliers are informed with latest technologies), and a supplier communication in general. Improving supplier communication abilities through formal teaching and learning should positively influence KM activities (Reed & Walsh, 2002) leading to SD initiatives that are more successful in knowledge transfer between the participants.

3.1.5 Supplier development motivation

When a supplier is highly motivated in an SD program, they will be more willing to execute the mission, to engage in KM activities, and to achieve the SD goals. Although insufficient by itself, SD motivation acts as a catalyst for achieving the desired outcomes when all other elements are present (Joshi, 2009). In an SD initiative, motivating KM activities through enhancing supplier affective commitment should be more motivating leading to a higher transfer of knowledge and in turn to positive SD outcomes.

3.1.6 Management skills

Effectively managing SD initiatives is the main role of the SD managers (Giannakis, 2008). SD managers should acquire multivariate skills to deal with the complexity of the knowledge transfer process. Chen et al. (2011) found that most SD managers, in different industries, lacked sufficient knowledge about processes, latest innovations, and training skills. The presence of managers who are characterized by technical, managerial and behavior skills can better deal with the complexities inherent to KM activities, especially in the aerospace sector, leading to more effective SD initiatives.

3.1.7 Goal congruence

In general, the goals of buyers and suppliers are at odds. While buyers aim for more quality and timeliness for a lower price, suppliers seek the best profit margin. These conflicting goals can negatively affect KM activities. Goal congruence leads both parties to seek compatible goals and has been associated with several positive outcomes (Jap & Anderson, 2003; Samaddar & Kadiyala, 2006). Similarly, having common objectives and goals in SD initiatives should allow buyers and suppliers to communicate and cooperate more effectively, engage in more efficient KM activities, and thus experience higher levels of knowledge transfer (Jap and Anderson, 2003). This should make SD initiatives characterized by high levels of goal congruence more likely to achieve their intended goals.

3.2 Conclusion

Identifying these KM enablers that are associated with effective KM activities should enable us to better plan and manage SD initiatives. Together the aforementioned enablers should be used in creating a superior knowledge management environment. An initiative that endorses and

promotes all these KM enablers in its implementation is expected to be more successful and consequently will be able to achieve its goals more effectively. I next give a brief overview of the aerospace industry and discuss specific features that should be targeted by SD initiatives to increase the performance and competitiveness of the industry.

4 The Aerospace Industry

This chapter starts by discussing the recent transformations happening in the aerospace industry that have led to the change in its structure and processes followed by a summary of challenges that have big impact on SMEs. I then explain the importance of SD initiatives in the aerospace industry as well as several specific features that should be considered to perform more effective SD initiatives. In the last section, I present a review of the Canadian aerospace industry since this thesis is conducted in Canada and contains SD initiatives from three regions in Canada.

"The Aerospace industry is considered as a highly strategic sector and a solid national aerospace industry is therefore a symbol of strength" (Dostaler, 2013, 32). The aerospace industry positively affects the country's GDP, revenue, employment, and R&D (The aerospace review, 2012b). The recent restructuring in the aerospace industry lead first and lower-tier suppliers to take on an increasing portion of the risk as they invested more in their partners when it comes to the production, development, and assembly of big aircraft systems and subassemblies (Gardes, Dostaler, Barredy & Gourmel-Rouger, 2015). So, if any aerospace industry wants to be competitive in the global market, local suppliers should be enhanced and developed to be able to compete with international ones.

Initially, the aerospace industry was vertically integrated, with specialized items being provided by suppliers. Aerospace original equipment manufacturers (OEMs) were responsible for activities which included: engineering, R&D, and manufacturing structures all of which were activities performed in house (Aerospace supplier program, 2004). OEMs were responsible for the production of large aircraft subsystems, in addition to system integration and assembly (Gardes et al., 2015). Engines and avionics were two of the few components that were purchased

from external suppliers. The structure of the single component supply chain was simple with OEMs' orders going from the first tier suppliers to the bottom tier suppliers at little risk. This simple process was due to the inclusion of various companies at different stages of production by OEMs. This process is defined as "vertical integration". In this case, OEMs tolerated the majority of the risk associated with the complexity and uncertainty in the industry.

Different structural changes in the aerospace industry have led to the emergence of a new type of supply chain (Deliotte, 2013). This new supply chain is called the "risk sharing approach" and it puts pressure on low tier suppliers to improve their performance through cost reduction and, among other things, quality and flexibility improvements (Dostaler, 2013). The most important changes are: first, when markets grow at a rapid rate, OEMs and first tier suppliers had to improve and develop their performance and capabilities in order to stay connected with these markets. One of the main challenges in the aerospace supply chain is globalization, in which competition is becoming increasingly aggressive. Second, new players were introduced, such as Russia, China, India, Japan, Brazil, and Mexico. These countries have sufficient resources and are very ambitious to build strategic sectors such as aerospace. For example, the government in India has funded and developed a large number of aeronautical R&D centres attracting many aerospace firms (Chandra, Shekar & Raghavendra, 2015). Third, OEMs had to increase their focus on integrated systems assembly and therefore, reduce manufacturing in house. This has led first tier suppliers to invest more in manufacturing and engineering skills in order to provide OEMs with big aircraft subsystems and subassemblies (Gardes et al., 2015). This change pushed OEMs to limit the number of suppliers and demand a collaborative relationship. Last, global competition in lower tiers is becoming increasingly fierce with the emergence of low-cost manufacturing workforces providing quality products.

A vertical disintegration supply chain has emerged due to all the changes that have impacted the supply chain at every level. The majority of activities are being outsourced to suppliers and OEMs have started to rely more on suppliers to provide them with complete subsystems and modules (Rebolledo & Nollet, 2011). In such a demanding environment, the relationship between OEMs and suppliers has started to become increasingly complex and challenging. To gain more focus on system integration and decrease the level of manufacturing and direct interaction with several suppliers, OEMs have started to become more dependent on the tier one suppliers (Chandra et al., 2015). The heavy reliance of companies on suppliers to provide them with the necessary components has led them to focus more on these suppliers' capabilities and performance. Figure 1 gives a graphical representation of the tiered structure of the aerospace industry

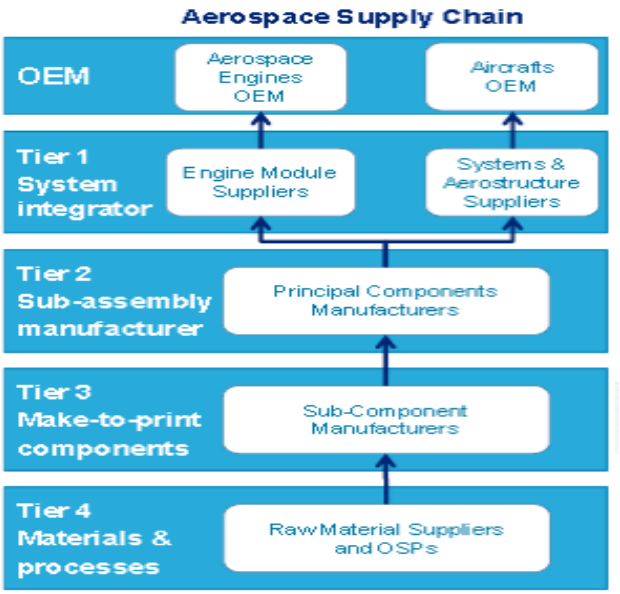

Figure 1: structure of the aerospace supply chain

4.1 Challenges in the aerospace industry

The aerospace industry is facing many challenges which are expected to have a big impact on the future growth of the sector (Chandra et al, 2015). Firms can respond to these challenges only if they acquire the necessary human, financial, and technological resources (Alfonso Gil & Vazquez-Barquero, 2010). Owners of SD initiatives should understand these challenges clearly and implement the required techniques that could help aeronautical companies face these challenges in a more global market. Table 1 presents a summary and a brief explanation of the most important challenges that the literature reports when it comes to firms in the airline industry.

Table 1: challenges in the aerospace industry

Challenge	Description
Supplier reduction program	The reduction of suppliers increases the pressure to continuously improve performance and provide OEMs with first-rate products. Suppliers should achieve the title of "preferred supplier" through integration processes, knowledge sharing, technological training and effective management of the supply chain (Aerospace supplier programme, 2004).
Efficiency improvement	In-house costs must be controlled (Aerospace supplier programme, 2004), using joint supplier improvements in information systems which help in the exchange of necessary data at the right time of aeronautical product development (Fan et al., 2016).
Regulations in industry	Standards and requirements which ensure that suppliers are attaining a specific level of quality of their products and considering high standards of safety. AS9000 is an aerospace quality system standard which was developed by a group of US prime contractors. Its aim is to regulate and reorganize many aerospace management standards. This standard is based on ISO 9000 with 27 additional requirements related to the aerospace industry. Later, a standard called AS9100 replaced AS9000 taking into consideration all the requirements of ISO 9000 in addition to many requirements related to safety and quality. For example, in the Canadian aerospace industry, all aeronautical companies require approval from two organizations: the Federal Aviation Administration (FAA) and Transport Canada Civil Aviation (TCCA) (Quintana et al., 2010).

Global sourcing and competition	Outsourcing poses a challenge for local small and medium aeronautical suppliers (Rossetti& Choi, 2005). The emergence of new players in the aerospace industry (such as Brazil, China, India, and Mexico) is another challenge for aeronautical companies (Chandra et al., 2015) in which first tier suppliers have many sources that are able to provide products at low cost and good quality (Dostaler, 2013). This increases competition between suppliers. The global sourcing of products increases the distance between the place of the design and the place of the manufacturing which leads to many barriers and challenges in manufacturing aeronautical products (Chandra et al. 2015) that leads many aerospace manufacturing companies restructured and re-engineered.
Partnering for increasingly complex work packages	Partnerships between OEMs and suppliers and between suppliers themselves are by far the most important factors in the succes of any project even though partnerships are considered to be a challenge due to the complex management of the relationship (Smith & Tranfield, 2005).
Compliance with customer requirements	The wide dispersal of the supply chain in the aerospace industry leads to communication problems and in turn to designing products with incorrect specifications (Chandra et al., 2015)
Carbon footprint	An additional challenge is being environmentally friendly in production (metal cutting) while still keeping costs low (Boswell et al., 2013)
Airline companies	An airline company's ambition is not to have an average fleet but to be fleet leader, so they put a lot of pressure on aerospace integrators as well as on suppliers. At the Global Aerospace Summit 2014 in Abu Dhabi that focuses on the future of the aerospace manufacturing industry, airline companies requested aerospace companies and suppliers to be perfect in production and innovation because they target perfection in their work.

4.2 The importance of Supplier Development in the aerospace industry

The importance of SD in the aerospace industry is due to the heavy reliance of OEMs on suppliers' capabilities and performance. Shifting the supply chain management responsibility from the OEMs, leads to the need for development of tier 1 and tier 2 engineering integration capabilities (Fan et al., 2000). In order to maintain a competitive supply base, many aerospace industries have started to implement supplier development programs (O'Chareon & Bispham, 2015). These programs are vital in improving the supplier's quality, responsiveness, flexibility, process, production, and technological and innovational capabilities (Dostaler, 2013). Technological innovation is one of the most important factors in the aerospace industry (Varga & Allen, 2006) which leads many buying companies and even the industry to create technological programs to help SMEs improve their technological ideas and keep pace with technological advancement. Due to the importance of technological factors in this industry, Reed &Walsh (2002) concluded that sizeable companies should use SD programs in order to provide better technological and innovation management. Not only companies, but also governments have co-funded aerospace SD initiatives to facilitate communication and collaboration among aerospace companies, researchers, and academics (The aerospace review, 2012a) in an effort to increase the technological and innovation pace. The report done by the aerospace review (2012a) also recommended that a national certification framework should be designed recognizing efforts made by SMEs that participate in SD initiatives.

4.3 Supplier Development features in the aerospace industry

After discussing the structure of and the challenges faced by the aerospace industry and the importance of SD initiatives in it, we now discuss the main features of the industry that the literature identifies as being crucial for the success of SD initiatives.

4.3.1 Technological and innovation capability

According to Dostaler (2013), technology defines the very nature of the aerospace industry and without a high level of technological capabilities, companies producing aeronautical products cannot survive. In the aerospace industry specifically, Reed and Walsh (2002) studied the effect of enhancing technological abilities through SD programs. Utilizing two case studies about two aeronautical companies in the United Kingdom, the authors found that there was a low emphasis on technology in general. The most important factor that enabled the technological advancement was increasing the buyer's awareness of the suppliers' contributions. As such, the same factor that influences technological capabilities has been found to enhance supplier-buyer interaction which is critical if SD initiatives are to be fruitful. Buyer's awareness was enhanced by supplier development assessments especially in the areas of development and design. Another factor was the depth of engineering involvement in the supplier developmental team. The involvement of engineers increased communication about technological information between parties which then lead to stronger aeronautical network. Again we can see how communication, a core aspect of SDs in general, can be related the technological capabilities of the parties involved. As such, technological and innovation capabilities can be considered to be a critical industry feature that affects the success SD initiatives.

4.3.2 Financial resources and market coverage

In another study done by Dostaler (2013) in the Canadian aerospace industry, she presented a framework that explains the most important factors that suppliers should have in order to compete in the global aerospace supply chain market. These factors are: price, dependability, reputation, quality, service, responsiveness, flexibility, technology managerial capabilities, financial resources to fund non-recurring costs, and inside knowledge of requirements. In this study, the author concluded that Canadian aerospace suppliers have acquired the key success factors they need to be competitive while most of them lack the marketing presence and coverage. This shows that small suppliers have the capability but they are not well-known enough in the market to be recognized by big aerospace OEMs. They need more financial resources to invest in the marketing business in order to be able to compete globally and invest more in business development. Financial resources and market coverage are the other features that should be supported by the SD initiative in the aerospace industry.

4.3.3 Clusters

Clustering acts as a simulator for the overall development of the local industry and its success (Chandra et al., 2015). Porter (2000) defined clusters as "*Geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standard agencies, and trade associations) in a particular field that competes but also cooperate" (p.15).*

Many aeronautical clusters such as Toulouse, Seattle, North West England, Chengdu, and Quebec were studied by authors who shed light on the importance of clusters for the success of SMEs (Chandra et al., 2015; Enright & Williams, 2002). The emergence of a large number of aerospace clusters is due to many changes that affected the structure of the aerospace supply

chain. The traditional model has started to disappear and a new restructured and more flexible and agile forms of organizations of production such as firm networks and clusters have developed (Alfonso Gil & Vazquez-Barquero, 2010). After digging deeply in the articles talking about aerospace clusters in different countries and regions, a detailed explanation is presented about the most important elements that clusters can offer to enhance developmental initiatives in the aerospace industry. First, knowledge spillovers enhance the dispersion of knowledge among all the players of the cluster. Local firms, associations, academic organizations, R&D centers, all play an important role in knowledge diffusion in the cluster. International knowledge spillover has been given an important role in transferring massive amounts of knowledge due to the complex product design and hundreds of documents and specification per product (Niosi & Zhegu, 2005). This dispersion of knowledge will help local players to be more capable and competitive. Implementing SD initiatives within a cluster the aerospace industry will benefit from the high level of knowledge spillover. Second, the more organic the cluster is, the more the relationship between its players is strong and everlasting (Grades et. al., 2015). Clusters should grow and develop organically instead of being created by governments. In synthesized clusters, big firms will benefit more than small firms because of their connections with government. While in the organic cluster or firm's agglomeration the financial funds provided by the government or provincial authorities will be distributed equally among the participants in the cluster and small companies will be given priority for development. The relationship between firms in the organic cluster is more beneficial because the players themselves develop their relationship without any intervention from other parties. Owners of SD initiatives should implement more such programs in organic clusters since the relationship there is more spontaneous, trustful and strong. Third, collaboration is one of the main targets of SD initiatives.

The high level of inter-firm collaboration is considered a superior way to develop suppliers. Collaboration is an important characteristic of strong and effective clusters (Cumbers, Mackinnon & Chapman, 2003). SD initiatives should be implemented in strong clusters so that collaboration between participants in the cluster will increase the success of the initiative**.** Finally, governments play a very important role in providing financial funding as well as other resources to the clusters. Governments provide support to clusters by removing obstacles and minimizing inefficiency that hampers productivity and innovation in the cluster. Also in many other clusters, governments afford technology grants and developing policies to enhance the competitiveness of individual firms. When SD initiatives are implemented in clusters, governments act as the main supporter of these initiatives (Porter, 2000) and the support of government in such developmental activities will lead to the success of the SD initiative and in turn to increase competitiveness of SMEs. Thus, implementing SD initiative within a cluster impacts positively the SD effectiveness.

4.4 The Canadian aerospace industry

Aerospace is a key sector of Canada's economy and the Canadian aerospace sector contributes significantly to the prosperity of Canadians. The sector employs about 80,000 people mostly in high wage jobs and had annual revenues of about 27.7 billion dollars in 2014 (AIAC, 2015). The sector characterizes by its advanced technology and research and development representing about 1.8 billion dollars of investment in 2014. Canada has enjoyed the status of the 5th largest aerospace industry after the US, UK, Germany, Japan and France (The aerospace review, 2012a). Canada exports about 80% of its production, and the largest foreign market for aerospace products is by far the United States; it accounts for over half of Canadian exports (Arcand, A.,

2012). Quebec accounts for the highest percentage, 56% of manufacturing to direct GDP, and western Canada accounts for the highest percentage, 44% of MRO to direct GDP.

The figure below shows the percentages of manufacturing and Maintenance, repair and overhaul (MRO) by region.

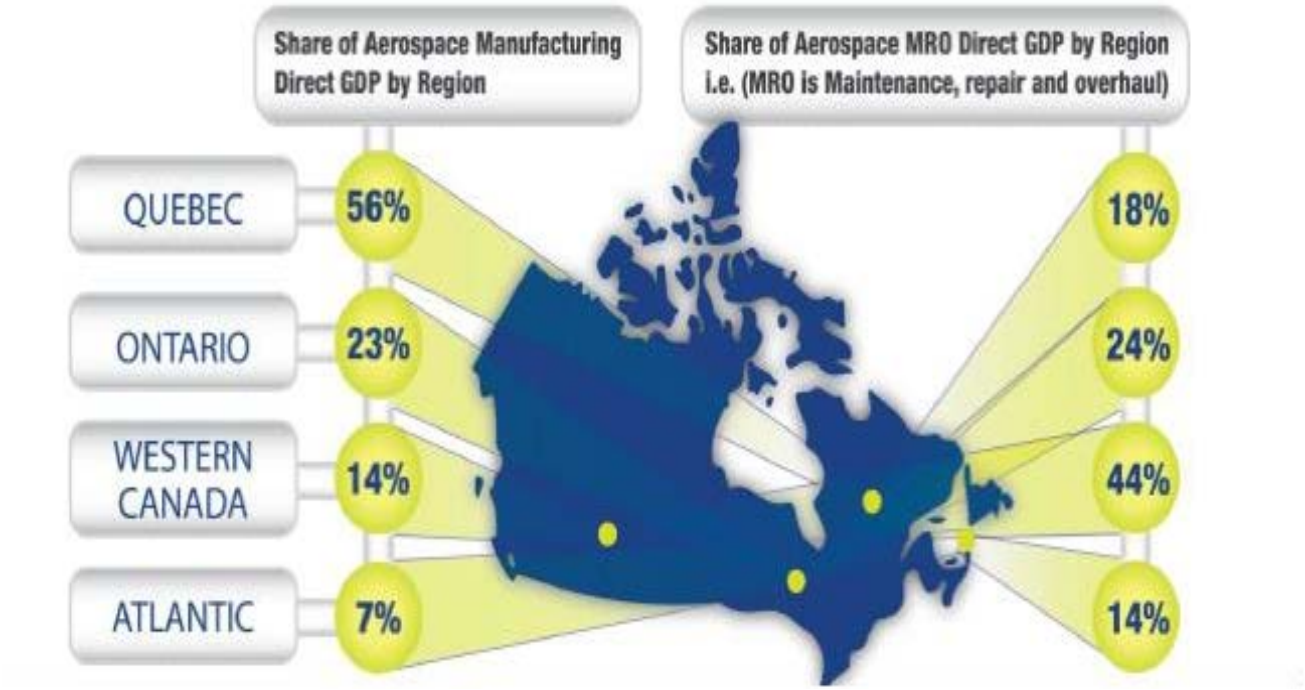

Figure 2: Innovation, science, and economic development Canada (2016)

In total Canada has 8 OEMs and 36 tier 1 system integrators and a large number of tier 2, 3 and 4 suppliers (Innovation, science, and economic development Canada**,** 2016). In order to sustain the leadership position of the industry and compete globally, well-implemented supplier development programs can play a very important role in achieving this success and enhancing

collaboration and communication between aerospace companies and other players in the industry. In 2011, two supplier development initiatives have already started to work on this mission in Manitoba, Ontario and Quebec. Shedding light on the Canadian aerospace industry is critical as three out of five initiatives involved in the analysis are Canadian SD initiatives. Interviewees will give their opinions about SD initiatives in the aerospace industry in general, and they will also answer questions related to the Canadian industry and the SD initiatives implemented in it.

4.5 Conclusion

As a conclusion, I have provided a global sketch about the industry and the changes that have occurred in the structure of the aerospace supply chain in the introduction of this chapter. Following the introduction, a table was constructed to list the most important challenges in the aerospace industry. Due to the importance of the supplier development in the aerospace industry, I presented the most important research done about supplier development in the aerospace industry followed by the four important features that should be considered when implementing a supplier development initiative in the industry. These specific aerospace features are: technological and innovation capability, financial resources, market coverage, and clusters. Identifying specific aerospace features that are associated with the effectiveness and success of the SD program will provide more data to SD initiators regarding the importance of the promotion of aeronautical features in implementing SD programs. So far, the aforementioned features are very efficient in creating a high level of technological and innovation level. The initiative that endorses and promotes all the aerospace features in its implementation is expected to be more successful and consequently will be able to achieve its goals more effectively. Thus,

technological and innovation capability, financial resources, market coverage and clusters are the aerospace features that should be considered in the implementation of any SD initiative.

5 Research Methodology

Following the literature review on the supplier development implementation, knowledge management activities, and the aerospace features, this chapter presents and justifies the methodology used to tackle this research's purposes. The chosen methodology consists of two main methods: the first is documentary research which consists of analyzing documents and reports about SD initiatives. Five SD initiatives are included and for each initiative several reports and documents are used, from the time the initiatives were launched until now. All initiatives are ongoing except for the one implemented in Mexico (PDP). In addition to reports, annual directory documents with the potential to reveal the continuity of the program and its effects on both suppliers and the industry are also made available. Thus, the analysis of these documents will allow each initiative to be assessed, and show practical effects and challenges, and determine the best practices.

The second methodology used consists of interviews with several leading figures in the industry. These interviewees presented their opinions and insights on the different aspects of SD initiatives. The interviewees are experts, leaders of SD initiatives, and consultants. Their opinions will help to better understand the key factors of SD initiatives in the aerospace industry. Together, these methods will allow us to develop a list of key elements and features important for implementing SD initiatives.

5.1 Documentary Research

Since Stock (1997) has called for enlarging the scope of logistics research by using qualitative methods, there has been a shift toward more qualitative research such as case-based approaches (Vafidis, 2007), and documentary research (Sachan & Datta, 2005). The qualitative method

called “documentary research” is valuable for studying human perceptions and actions that influence the effectiveness and performance of logistics processes (Trautrims, Grant & Wong, 2012). Several studies in supply chain management rely solely on documentary analysis (Wild, Macmahon, Darlington, Liu & Culley, 2009). They use the daily documents and reports to study engineers' information needs and document usage. Documentary analysis is “a systematic procedure for reviewing or evaluating documents—both printed and electronic (computer-based and Internet-transmitted) material. Like other analytical methods in qualitative research, documentary analysis requires that data be examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge” (Bowen, 2009, p.27). According to Bowen (2009), a document is a form of written text that is produced by different people and organizations for various needs. The researcher must acknowledge that these documents have been written with a purpose and are based on assumptions; which is why one should be aware of the origins, objectives and motives of the documents written and used.

Although documentary research is not optimal for tackling quantitative research questions like mathematical and optimization problems in logistics (Trautrims et al., 2012), it is appropriate for answering “why” and “how” research questions. The value of documentary research is presented through the focus on not only “what” the process, program, or system is but also on “how” the process is constructed, perceived, and performed by those engaged in it. Therefore, documentary research provides a method for recognizing issues and problems involved in the daily operation of logistics (Trautrims et al., 2012). Documents that may be used for systematic evaluation as part of a study take a variety of forms. They include advertisements: agendas, attendance registers, and minutes of meetings; manuals; background papers; books and brochures; diaries and journals; event programs (i.e., printed outlines); maps and charts; newspapers; press releases;

program proposals, application forms, and summaries; radio and television program scripts; organizational or institutional reports; survey data; and various public records. Scrapbooks and photo albums can also furnish documentary material for research purposes. These types of documents are found in libraries, newspaper archives, historical society offices, and organizational or institutional files (Corbin & Strauss, 2008).

5.1.1 Reasons for Documentary Analysis

Documentary analysis is a useful method to investigate performance improvement and evaluation initiatives in organizations (Pershing, 2002). Using documentary analysis is very practical due to several reasons: first, a documentary research is a method that is applicable to qualitative studies that requires rich descriptions of a single phenomenon, event, organization, or program (Stake, 1995; Yin, 1994). Second, it is an efficient method which depends mainly on selecting the precise and accurate documents and reports to analyze (Bowen, 2009). Third, the availability of most of the documents about several supplier development programs which are supported by the government. A lot of these documents concerning these initiatives are in the public domain and can be accessed easily. As with Merriam (1988), when an event is related to the public, some official record of it most likely exists. Fourth, documentary research is often the required method when collecting data about a specific topic is not viable. The value of this research lies more in the content and quality of the documents and reports collected than on the way this information is analyzed (Bowen, 2009). Lastly, Supplier development initiatives tackled in this thesis are implemented by trade associations that are well known and supported by governments. Usually, owners of such developmental programs release well developed reports and statistical documents about their work. So, our mission is to scrutinize these documents and reports and identify initiatives' effects as well as crucial elements. The nature of the aerospace

industry depends on high levels of confidentiality and secrecy. Getting information about SD initiatives implemented in the aerospace industry, and contacting individuals who work in this sector is very difficult. Due to the challenging and competitive nature of this industry, it is difficult to get any information from managers about any SD initiatives, procedures, processes, detailed funding reports, and many other factors. Therefore, this thesis's analysis depends heavily on the documentary research methodology.

5.1.2 Primary and secondary documents analyzed

Primary documents are extracted from the official web sites of the trade associations (www.aeromontreal.ca , www.maa.ca and www.theoac.ca) which are responsible for the implementation of SD initiatives. Other documents are governmental publications such as the Aerospace Review, in addition to journal articles used in the literature review that aid in the deeper understanding of the Supplier Development topic, aerospace industry, knowledge management and clusters. Secondary documents are press release articles, reports of university studies done in the aerospace industry (e.g. McGill study of SMEs in aerospace industry in Quebec) in addition to several documents and reports released by government websites containing statistical information about the industry.

5.1.3 Elements of documentary research

Handling documentary research requires a special approach. Scott (1990) designed quality control criteria for handling documentary sources. These are authenticity, credibility, representativeness, and meaning. Authenticity is the provision of detailed information that shows the accuracy and validity of these documents (Trautrims et al., 2012). This research is authentic because it deals with documents that cover the topic in a broad and complete way. For

example, the document of SC21 initiative about implementation factors lists all the steps that participants go through till they graduate. This research is also credible as we had access to a wide range of documents. The usage of a considerable number of high quality documents shows the richness of the method. Representativeness is also present in this research as can be seen by the effort done to find supplementary documents when information was deemed missing.

5.1.4 Supplier Development initiatives included in the analysis

Extensive research on SD in the aerospace industry identified seven programs in total: SC21 in UK, SiG (Sharing in Growth) program in UK, Mach initiative in Quebec- Canada, CESD initiative in Manitoba- Canada, Esprit initiative in Ontario Canada, PDP initiative in Mexico, and the Gold program implemented by Pratt and Whitney aerospace company. Only five were selected to be part of this research. These five were chosen because our focus was on SD initiatives and thus privately funded programs were not selected such as the Pratt and Whitney's program. Although publically funded, the SiG initiative was not considered in the analysis because we were not able to obtain enough documentation regarding the participants and the steps of implementation of this initiative. We should mention that the number of initiatives studied was also limited by the high level of confidentiality in the aerospace industry. This characteristic prevents access to information about additional SD initiatives. The five initiatives included in the study are stated below.

5.1.4.1 British initiative (SC21)

SC21 initiative is a supplier development initiative developed by the organization called "Aerospace, Defence, Security" (ADS). ADS is "an improvement programme designed to increase the performance of suppliers and ultimately their supply chains within the UK

aerospace, security, and space and defence industries". According to ADS, the program is working with signatory companies, prime contractors, regional trade associations (RTAs), strategic partners and accredited training providers. The supplier development initiative SC21 provides groups of industry representatives that support the development of special areas of interest. ADS is a trade organization for companies in the UK Aerospace, defence, security and space sectors. There are more than 1000 UK signatories in the organization. The SC21 initiative was initiated in 2006; it has over 600 signatories on the programme. An important benefit of a new, wider involvement in defence and security is the ability to cross-fertilize between the industries and enjoy better communication and diversity for the programme. Furthermore, with signatories at various stages of their development, such as continuous improvement planning, carrying out business excellence diagnostics and possibly receiving an accredited award, the SC21 signatories can support each other regardless of their position on the journey to excellence. It provides improvement in the following areas to signatories: business benefits, quality delivery, relationships, and stakeholder's benefits.

5.1.4.2 Canadian Initiative (Mach)

Mach Initiative is a supplier development initiative developed by the organization called "Aero Montreal". Aero Montreal is a Quebec aerospace cluster that combines all the decision makers in the aerospace sector, including companies, research centres, educational organizations and governmental institutions. The Mach Initiative will be deployed over five years under the mentorship of prime aerospace companies in Quebec. From its inception in 2011, Aero Montreal has nominated 50 Québec suppliers to participate and benefit from services offered under the initiative. It has also provided expertise and support of more than seven world-class prime contractors (Aero Montreal, 2017).

5.1.4.3 Canadian Initiative (CESD)

The Competitive Edge Initiative is a supplier development initiative developed by the cluster "Manitoba Aerospace" (MAA), and "Manitoba Aerospace Human Resource council" (MAHRC). Manitoba Aerospace Human Resources Council (MAHRC) is "committed to facilitating positive change in Manitoba's aerospace sector and beyond in the area of training and human resources services by working with industry, individuals, institutions and governments". The partnership between local, provincial and federal government intends to prepare a skilled workforce for the future coupled with an innovative technological climate (MAHRC, 2017). The Competitive Edge (CESDP) was initiated in 2010, provides a framework to develop an organization's capabilities in Manitoba.

5.1.4.4 Canadian initiative (Esprit)

Esprit is a supplier development initiative developed by the organization called "Ontario Aerospace Council" (OAC). OAC is committed to "driving business productivity improvements in several key Ontario Aerospace supply clusters through the adaptation and adoption of new technologies, processes and skills development by firms at all levels in the targeted clusters/supply chains". Esprit targets specific aerospace clusters of companies in an effort to encourage supply chain development through collaboration. A "cluster" is a group of companies all involved in a specific product supply chain, with defined Tier- level positions within the supply chain, located in a specific geographic region. Ontario's aerospace industry has several key clusters (The aerospace review, 2012a).

5.1.4.5 Mexican initiative (PDP)

PDP (Programme Desarrollo De Proveedores) is a supplier development initiative created and operated by the United Nations Development Programme in Mexico and supported by the Mexican Ministry of Economy. This program is focused on implementing a method that depends on world "best practices" with the aim of being adopted by local suppliers in several industries, such as energy, food, automotive, electrical and the aerospace sector. According to PDP, the initiative's objectives are: integrating SMEs in Mexico, improve the efficiency of the companies by promoting flow of information, contribute to the strength of the internal market, and increase the involvement of SMEs in exportations market. The key players are the Ministry of Economy, development banking, industrial chambers, and the UNDP office. By 2002, the Supplier Development Programme was being tested in five large companies and their value chains, and its methodology adjusted according to the results. In 2007, the Mexican government adopted the program as public policy, increasing its budget and expanding the number of value chains assisted. By the beginning of 2010, the program was serving 56 value chains, headed by anchor companies such as Nestlé, Bosch, Bombardier, Wal-Mart, Volkswagen, Bimbo and MetLife.

5.2 Semi-structured interviews

One of the most important methods being adopted in operations management is the classic method of conducting informed and thorough interviews. Interviewing is considered to be one of the most important methods in research design (Weiss, 1994). According to Kvale (1996), an interview is a conversation with an aim to gather descriptions of the interviewee with respect to an explanation of the meanings of the 'described topic'. In-depth information about certain topics can be extracted from interviewee's answers in an extendable, naturalistic, and less structured interview (Schostak, 2006). There are four types of interviews that are frequently used by

researchers: structured, open-ended, semi- structured, and focus group interviews. For the purposes of this research we employed semi-structured interviews. This type of interview lies somewhere between the structured and the unstructured. Semi structured interviews depend on check lists and interview guides. Here, the interviewer is able to have answers to questions in addition to the spontaneous elaboration that the interviewee brings to specific issues. Semi-structured interviews are found to be very useful mainly because comparability is not required for this type of interviews since sequencing and wording is different in each interview adding flexibility to the conversation between the interviewer and the interviewee (Gravel, 1986). Knowing the opinion of experts about SD initiatives in this field not only supports and enriches the results of the analysis but also gives additional information for discussion.

When undertaking such interviews, researchers recommend using a basic checklist (Berg, 2007) that would help cover all relevant areas (i.e. research questions). A checklist and interview guide was created for the purpose of this thesis. The interview guide included questions related to the SD initiatives' characteristics and steps of implementation. The guide also had questions related to the interviewees' opinion regarding the effect of different variables on the SD initiative effectiveness. Last, the guide included a few questions designed to probe the interviewees' opinions about special features that should they considered especially important for SD initiative in the aerospace field (Appendix 1: Interview Guide).

5.2.1 Validity and reliability of semi structured interview

Ensuring the validity of an interview rests in understanding the respondent's construction of reality. Asking questions that make the respondent tell the answer in their own way and in depth rather than imposing questions in a rigid and strict manner. The more the interviewer can ensure a relaxed environment, the more the interviewee is willing to report their belief and opinion.

Given the sensitivity of some of the information I communicated a brief summary of the topic and the interview guide. This intended to make the interviewees more comfortable to answer the interview questions spontaneously. I tried to avoid leading questions and preconceived ideas that might influence the discussion.

5.2.2 Confidentiality purposes

This research followed the ethical guidelines of the HEC Montreal schoool of business. Interviewees were presented with a consent form that included, in addition to information regarding the researcher, topic, and thesis supervisor, two questions regarding their approval to be recorded and that their personal information be included in the final report. All interviewees agree to be recorded; however, one requested that their name not be shared. Recordings were transcribed by the primary researcher and both the audio and text files were kept on an encrypted USB drive (see Appendix 2: Consent form)

5.2.3 Participants

The participants are experts in the aerospace industry in Canada who have wide and detailed knowledge about the field in general and SD initiatives in particular. Table 1 includes the names and a short summary about each interviewee.

Table 2: information about experts interviewed

Name of the interviewee	Background information
Jacques Roy	• Professor, Department of logistics and operations management at HEC Montreal • Director of the chain research group • Supervisor of Carrefour logistics • Member of the advisory council of "The Aerospace Review" Mandated by the Government of Canada
Isabelle Dostaler	• Professor, Department of Management at Concordia University

	• Expert in the aviation and aerospace industry in Canada
John Kliewer	• Leader of and consultant for the CESD initiative • Expert in senior human resources and leadership consulting services • Founding member of the CESD services team with 15 years of leadership experience in the aviation field
Expert in the industry	• Researcher in the aerospace industry • Program director at an aeronautical research center
Howard Loewen	• Current president of Micro Pilot company in Manitoba (Aviation and Aerospace products) and in charge of developing business and technology strategies

5.3 Analysis

Guided by the extensive literature review, I first examined the documentation collected about the five SD initiatives coding for all text relating to the above identified supplier development factors, knowledge management elements, and the main success features in the aerospace industry. These where then compiled to generate an assessment of each initiative. I then conducted a comparison between the five initiatives on the various factors, elements, and features. After the documentary analysis was finished, I performed a series of structured interviews with subject matter experts. As mentioned, the interview guide was prepared and the interviews conducted in an effort to cross-validate or refute the findings of the documentary analysis. In addition to their opinions, the experts were asked to comment on the assessments generated using documentary research.

5.4 Conclusion

Basing ourselves on theory and previous findings we utilised both documentary analysis and semi-structured interviews to answer the identified research questions. While documents were

used in the initial assessments and comparisons, the vast knowledge of our combined sample of experts was utilised to examine and elaborate on the findings. We present these findings in the chapters that follow.

6 Assessment of Initiatives

The empirical core of this thesis focuses on the study of five different SD initiatives in the aerospace industry. This chapter will provide an overview of each of the five SD initiatives (SC21, Mach, CESD, Esprit, and PDP) presenting a review about the aerospace industry in which they are implemented. A table summarizing the SD success factors followed by a discussion of the observed effects and challenges for each initiative is also presented.

6.1 British initiative (SC21)

6.1.1 British aerospace industry

The UK aerospace industry has around 110,600 employees in direct job sectors, $26.2 billion as turnover and 29.2 billion Euros as exports. 91% of Aerospace turnover is generated by exports (ADS, 2015). The UK has enjoyed the status of the 3rd largest aerospace industry after the US and France with a $32.7 billion (The aerospace review, 2012a). There are five main trade associations in the aerospace industry; each association is responsible for managing a region in the United Kingdom. ADS is the premier trade organization for the UK aerospace industry, defense, space, and security sectors, and has a membership of one thousand UK-registered companies. In 2006, ADS created a program called the Supply Chains for the 21st Century (SC21) as an improvement tool for increasing the performance of the suppliers, especially the SMEs. The program is a collaborative endeavor between signatory companies, primes, regional trade associations, strategic partners and accredited training providers.

6.1.2 SC21 - assessment summary

Table 3 presents the assessment summary for SC21. The first section discusses the SD factors important for the success of an SD initiative. As can be seen, all eight factors are present in the SC21 initiative. Section two presents the knowledge management enablers we identified as crucial for improving KM activities. Again, the SC21 displays evidence of all seven elements. The last section discusses only three out of the four main success features. In the case of this SD initiative, implementation was not within a cluster.

Table 3: SC21 assessment summary

SD factors	
Top management involvement	ADS is the top management of the initiative SC21. The involvement of the association is very clear from the initiating of special team and industry working groups to support the implementation of the initiative. In addition to working on involving prime companies, SMEs and regulatory bodies in the initiative in order to help in attaining the initiative's objectives and goals[2].
Supplier identification	Two options: self supported option and the prime supported option[3].
Cross functional involvement	The involvement of training partners in business, manufacturing, relationship, lean, continuous sustainable improvement plan (CSIP), accreditation and relationship[4]
Supplier evaluation[5]	Delivery Quality Business excellence (a framework for determing excellence) Relationship excellence (RelEx) Manufacturing excellence (a framework for lean operations)
Performance measurements	Performance matrices[6]: Delivery and quality matrices Relationship questionnaires Business and manufacturing tables
Implementation	Training and on site visits[7]
Continuous improvement	CSIP process depends on the inputs, required improvement plans and customer specific key point indicators[8]
Long term period	Ongoing initiative started 2006 till April 2017[9]

[2] http://www.sc21.org.uk/about/signatories-and-partners/
[3] SC21-Benefits-Brochure-v1, how do signatories implement SC21? Page 9
[4] http://www.sc21.org.uk/sc21-strategic-partners-and-training-practitioners/sc21-training-partners
[5] SC21-Imp-Guide-2014-v11, performance and development, page 17
[6] http://www.sc21.org.uk/sc21-toolkits-and-metrics/sc21-performance-metrics
[7] SC21-Imp-Guide-2014-v11, work streams and training, page 12
[8] http://www.sc21.org.uk/sc21-toolkits-and-metrics/sc21-the-continuous-sustainable-improvement-plan-csip
[9] http://www.sc21.org.uk

KM enablers	
Relational capital	Code of practice to measure relationship between participants (RRM)[10]
Asset specificity	Investments are granted by Regional Trade Association (RTA)[12].
Geographical and cultural proximity	All signatories are located in UK which reveals they have the same geographical and cultural properties.
Motivation	More than 1000 signatory are involved in SC21 out of 3000 aerospace companies in UK. It represents a percentage of more than 30 % of the whole industry. The self support involvement in the initiative reveals that companies are very motivated to participate in this initiative[13].
Management skills	The videos posted in "you tube" show participants talking about the professional skills that SC21's management has. For example, the Atlas composites company case and the aerospace seat design case[14]
Goal congruence	The mission of SC21 is very clear and suppliers are evaluated and developed depending on the same matrices and processes[15]. The management of SC21 said that "The objective of common supplier development programmes is to achieve efficiencies and remove duplication. Business excellence models such as EFQM is an integral element of any development programme"[16]
Formal and informal interaction	The upcoming and latest events and gatherings are listed clearly on the website of ADS in which formal and formal interaction can happen between participants for example "Task force" is the event that conducted every 3 month to gather participants in the program (Implementation Guide of SC21)
Specific aerospace features	
Technological and innovation capabilities	NATEP [17], "National aerospace Technological Exploitation program"
Government funds	Funded by RTA and government
Market coverage	Existence of many prime companies
Cluster	No formal cluster exists

6.1.3 Effects

According to ADS group (2010), the SC21 Benefits Brochure shows important improvements in both delivery and quality. The delivery performance for all suppliers participated in the program from 2007 till 2010 improved from 94% in 2007 to 99% in 2010. Also suppliers participated in SC21 were able to decrease the percentage of defects from 1% in 2007 to 0.3% in 2010. In addition to these statistical numbers that show the real improvements among the suppliers participated in the initiative from 2007 till 2010.

[10] RelEx Workbook Master V – A 201404
[12] SC21-Benefits-Brochure-v1, how do signatories implement SC21? Getting started, Page 9
[13] http://www.sc21.org.uk/wp-content/uploads/sites/23/2017/02/20170203-SC21-NSR-Website-1.pdf
[14] https://www.youtube.com/watch?v=VF2BEjlZ5LI, https://www.youtube.com/watch?v=KW7GhMU3Ftg
[15] www.adsgroup.org.uk
[16] http://www.sc21.org.uk/sc21-frequently-asked-questions/#aGroup_4
[17] http://www.natep.org.uk/

6.1.4 Challenges

To continue maintaining their global competitive position, UK manufacturers should discover new ways to meet the challenges in the aerospace industry (Carrol, S., 2016). One important challenge is the "fourth industrial revolution" where the adaptation of new technologies and high level of technological and innovational skills of employees is a must to survive. According to the latest report done by Deliotte (2016), another challenge to the UK aerospace industry is the global demand for air travel will grow at around 5% year-on-year into the mid-2030s. This increase in the growth rate would see the sector more than double in size over that period. New aircraft must be greener, quieter and more economical to run than those they replace. This represents a big challenge in creating and innovating new technologies that make new aircraft with the required market needs.

6.2 Canadian initiative in Quebec (Mach)

6.2.1 Quebec aerospace industry

Montreal is one of the important aerospace hubs in the world after Seattle and Toulouse, because of a high concentration of prime contractors, OEMs, integrators, MROs, and subcontractors. The Quebec aerospace industry employs over 42000 well qualified individuals and exports 80% of its production. Canada has enjoyed the status of the fifth largest aerospace industry in the world with $ 22.3 billion (The aerospace review, 2012a) of which the Montreal hub is the largest cluster in Canada. Currently, Aéro Montréal is the name of the aerospace cluster in Quebec; it is a public-private partnership that was initiated in 2006. Aéro Montréal's mission is to "mobilize industry players around common goals and concerted actions to increase the cohesion and optimize competitiveness of Quebec's aerospace cluster. It aims to foster the growth and

expansion of the cluster of Montreal, Quebec, and Canada" (Aero Montreal website). Thus, Aéro Montréal created the supplier development program "Mach initiative" in 2011 in order to increase the competitiveness of the supply chain management of the aerospace industries in Quebec. Below is the brief explanation of the program's implementation strategy, its special features as well as its effects and challenges.

6.2.2 Mach-assessment summary

Table 4 presents the assessment summary for Mach. The first section discusses the SD factors important for the success of an SD initiative. As can be seen, all eight factors are present in the Mach initiative. Section two presents the knowledge management enablers we identified as crucial for improving KM activities. Again, the Mach displays evidence of all seven elements. The last section discusses only three out of the four main success features.

Table 4: Mach assessment summary

SD factors	
Top management involvement	Aero Montreal involvement is very clear due to the creation of working responsible for implementing the initiative
Supplier identification	Mentor support decided by the working group and the mentor
Cross functional involvement	The working group members are individuals from prime and big aeronautical company of Quebec cluster
Supplier evaluation	15 processes[20] in three sets: leadership, workforce planning and operations sets • Leadership set : Strategic planning and positing, performance and measurement systems, project and risk management systems, innovation, and corporate social responsibility • Workforce planning set: workforce planning, hiring, workforce mobilization and retention, workforce training, individual performance evaluation. • Operations set: supply chain management, customer relationship management, manufacturing control and management, control improvement, engineering, methods and new products, and quality management.
Performance measurements	Mach initiative depends on certain scores to measure the performance of the supplier to see if the participant can move a higher Mach level.
Implementation	Training and on site visits done by the working group and the mentor company[21]

[20] Aeromontreal.ca

[21] The aerospace review (2012a)

Continuous improvement	5 levels program from Mach1 to Mach5 reveals the continuous improvement program
Long term period	Ongoing initiative started 2011 till April 2017
KM enablers	
Relational capital	Mach initiative is centered on collaborative client-supplier relationships[22]. Also, the CRM tool created by Aero Montreal includes a Customer relationship management and software that enriches databases and centralizes information. This tool ensures better management of communication and relationships between cluster members[23].
Asset specificity	Investments are granted by three levels of government; financial supports provided to SMEs in Mach initiative. The province of Quebec is funding to support SMEs in implementing their improvement plans in Mach initiative[24].
Geographical and cultural proximity	Quebec cluster is characterized by the closeness of geographical and cultural distance
Motivation	Companies are highly motivated in this initiative and there are 50 companies involved in the initiative so far. Thus, 50 companies are participating in the initiative out of 210 companies in Quebec (about 23%)
Management skills	Professional people from big aeronautical companies are members in the working group that is responsible for implementing the initiative.
Goal congruence	Common objectives and goals, companies are evaluated and developed on the same processes.
Formal and informal interaction	Mach events from 20 in 2012 to 176 in 2015 The number of projects is 465 projects (completed or ongoing) in 2015[25]
specific aerospace features	
Technological and innovation capabilities	SA2GE [26],"Aeronautical Systems for the Environment"
Government funds	15 million dollar over 5 years[27]
Market coverage	4 prime companies reveal a good market coverage
Cluster	Formal cluster exists

6.2.3 Effects

The Mach initiative now has around 50 suppliers which have participated in different Mach cohorts and four suppliers are in the fourth and the fifth cohorts. Moreover, the owner of the initiative Aéro Montréal takes into account the specific aerospace features as technological and innovation capabilities. The relationship between the mentor company and the suppliers assigned

[22] Profile-of—the- industry-in-greater-Montreal_single.Pdf
[23] Aero Montreal, Annual activity 2015
[24] The Aerospace Review ,supply chain development working group, 2012; www.aerospacereview.ca
[25] Annual Report Final-eng by Aero Montreal, 2015 Activity Report, INDUSTRY 4.0
[26] https://www.aeromontreal.ca/phase-2-sa2ge-greener-aircraft-development-project-dont-miss-request-proposals- smes-partners.html
[27] The Aerospace Review ,supply chain development working group, 2012; www.aerospacereview.ca

to it plays very important role in increasing the market coverage of the participating suppliers. As the mentor company is big and global, its development will also be potentially wide ranging. According to the Aero Montreal (2015), the report “Industry 4.0” shows the increase in the number of Mach events from 20 in 2012 to 176 in 2015 that reveals the high level of interaction and communication among Aéro Montréal’s members in addition to 465 projects in 2015 as completed or ongoing. In a report released by Aero Montreal (2016) named “white paper", the directors of the program stated that the initiative will be launched in Wallonia (Belgium).

6.2.4 Challenges

There are still many challenges and barriers that should be addressed by the owner of the SD initiatives in order to help SMEs face certain barriers in the aerospace industry (McGill, 2012). This report shows the most important challenges that SMEs are facing in the aerospace industry in Quebec and according to Aéro Montréal, suppliers in Quebec lack the financial resources to hire highly skilled people and train them to acquire the requisite operational and technical skills. Also they found that SMEs have difficulty in investing in manufacturing equipment and process improvement. They need to find strategies to keep their prices down and they cannot take the risk of high-level investments. Some SMEs still work on very simple and traditional computer software that is not compatible with the software larger companies have implemented in their systems. The two main challenges for SMEs in the Quebec aerospace industry are: difficulties in recruiting highly skilled employees and a lack of talented technical graduates from Quebec-based schools.

6.3 Canadian initiative in Manitoba (CESD)

6.3.1 Manitoba aerospace industry

The Manitoba aerospace industry is the third largest aerospace cluster in Canada. Manitoba industry focuses on complex components design and manufacturing (composites, metallic, and thermoplastics), precision machining, maintenance, repair and overhaul (MRO), and environmental testing of gas turbine engines (MAA, 2017). Manitoba aerospace employs over 5000 jobs and earns over 1.5 billion dollars annually — of which 80% of that is exported. It is Canada largest aerospace composite manufacturing centre. More than 60 aerospace firms are either headquartered or have major centres of operation in Winnipeg, including Boeing Canada Winnipeg, StandardAero, Magellan Aerospace and Cormer Aerospace. MAA and MAHRC are associations under the Aerospace Manitoba name. MARCHC is an industry driven not-for-profit sector and aimed at "developing a world class workforce to meet industry's needs through partnerships with Manitoba educational institutions and their key stakeholders and the industry directly"[32]. It is the owner organization which created the Competitive Edge Supplier Development program (CESD). CESD was established 2013 and focuses on developing suppliers who are seeking to sustain their existence in the aerospace industry in Manitoba.

6.3.2 CESD-assessment summary

Table 5 presents the assessment summary for CESD. The first section discusses the SD factors important for the success of an SD initiative. As can be seen, all eight factors are present in the CESD initiative. Section two presents the knowledge management elements we identified as crucial for improving KM activities. Again, the CESD displays evidence of all seven elements.

[32] Manitoba Aerospace Human Resource Council; http://mbaerospace.ca/mahrc

The last section discusses only three out of the four main success features. In the case of this SD initiative, implementation was not within a cluster.

Table 5: CESD assessment summary

SD factors	
Top management involvement	MAHRC involvement is very clear from the implementation guide of the initiative. The involvement of the management in each implementation step is very clear in the implementation guide in the MAHRC's website.
Supplier identification	Mentor support decided by the management of MAHRC and mentor company
Cross functional involvement	The involvement of most of the players in the industry
Supplier evaluation	11 foundational processes[33]: Leadership Strategic Business Planning (SBP) Project & Risk Management Lean Make vs. Buy Skills Development & Planning E-Business Innovation Collaboration Infrastructure & Facilities Management Sales & Operations Planning
Performance measurements	The measurement used by the CESD is the 50 points score. Each year an assessment for the 11 processes is done by CESD to examine the points of improvement in each process. All the processes are scored over 50. This depends on conducting observations and interviews with the leadership and the employees to examine the two perspectives[34]
Implementation	Bench mark process[35] SBP process (Strategic business planning process)[36] EELA (Executive Edge leadership Academy)[37]
Continuous improvement	5 levels program from learner level to world class level[38]
Long term period	Ongoing initiative started 2011 till April 2017
KM enablers	
Relational capital	Series of events to showcase the benefits of collaboration for industry are organized by MAA and MAHRC. The series will be made up of a number of workshops and breakfast meetings, each profiling a unique element of collaboration or partnership[39].
Asset specificity	The government funds 50 % of the expenses of implementing the initiative and

[33] http://cesdservices.ca/program/11-processes/

[34] XYZ company bench mark process over 6 years in CESD

[35]Benchmark process; http://cesdservices.ca/program/benchmark-process/

[36]SBP process; http://cesdservices.ca/program/strategic-planning/

[37] EFLA; http://cesdservices.ca/program/leadership-academy/

[38] The aerospace review, supply chain working group report, 2012, CESD initiative

[39] http://cesdservices.ca/training-calendar/

	the company participated funds the other 50 % of the fees.
Geographical and cultural proximity	The aerospace industry in Manitoba is very small and exists in one region. Aerospace players don't have any problems in geographical and culture proximity communicating with each others.
Motivation	Companies are all motivated to involve in the initiative and according to the leader of the initiative many companies registered to involve in this initiative. 6 companies out of 40 aerospace companies in Manitoba (around 15 % of the industry)
Management skills	Suppliers participated in the initiative talked about how the management is very efficient in educating and developing them (videos posted in the CESD website)[40]
Goal congruence	All members in the CESD are working toward same objectives and goals and this is clear from the case studies of the four cases of success presented in their website.
Formal and informal interaction	10 events per year Several workshops conducted per year and training sessions that tackle different topics in the operation management and leadership[41]
Specific aerospace features	
Technological and innovation capabilities	Participants working with the existing research centers in Manitoba for developing their technological and innovation ideas.
Government funds	2 million dollar over 5 years
Market coverage	1 prime company
Cluster	No formal cluster exists

6.3.3 Effects

The Competitive Edge Strategic Development (CESD) program has been proven to increase the performance of the companies which participated, in addition to the improvements that are unique to each company. The CESD website lists the cases of success over the 5 years. These are: Argus (journey to world-class at Argus), Enduron (Enhancing problem solving at Enduron custom), Gardner (Deploying strategic plan at Gardner Aerospace), and Keewatin Air (improving efficiency and employee synergy at Keewatin Air). The program works in a highly structured and systematic way to develop and improve suppliers which participated in the program. The leader of the CESD initiative provided us with a bench mark report (not public) for

[40] CESD; successful cases; http://cesdservices.ca/products/
[41] http://cesdservices.ca/training-calendar/

a company XYZ participated in the initiative over the last 6 years (Appendix 3: CESD bench mark process over 6 years for company XYZ).

6.3.4 Challenges

The most significant challenge is that there is only one prime company in the region of Manitoba. The mentors are responsible for improving suppliers, so the program is only able to develop a few suppliers. This will affect the number of improved suppliers over the period of the initiative. Manitoba is a region in which the aerospace market is very small and the region is not addressed by the government as the big markets in Ontario and Montreal (Canada2020, 2012)

6.4 Canadian initiative in Ontario (Esprit)

6.4.1 Ontario aerospace industry

Ontario is the second largest aerospace sector in Canada, which generates more than 6 billion dollars in annual sales and exports 80% from its products as well as 30% of the research and development projects that are done in Ontario (OAC, 2017). Fifteen top aerospace companies in the world have operations in Ontario. It is considered to be a leader in the space sector due to 70% of Canada's space revenues and 60% employment. The Ontario aerospace industry composed of 350 firms of various sizes with 22000 people employed in the sector[42]. Several international companies are located in the greater Toronto area such as Bombardier, Pratt and Whitney, Honeywell, Goodrich Landing Gear, Safran, Messier-Dowty, and Macdonald Detweiller. Ontario aerospace council (OAC) was established in 1993, a not-for-profit organization comprised of more than 200 member companies which represent 70% of the Ontario aerospace industry. The purpose of the OAC is to improve the existence of Ontario

[42] OAC2016CapabilitiesDirectory;OAC.ca

aerospace capabilities in the global market and work to ensure the growth and prosperity of the aerospace industry. To drive productivity improvements, the OAC created the supplier development program called "Esprit". Esprit is still in its conceptual phase waiting for the support of the federal development agency for southern Ontario. Since the program doesn't have any effects and best practices so far, this will be limited to an explanation of its structure as well as challenges and opportunities that are faced by OAC[43].

6.4.2 Opportunities and challenges

Canada2020 (2012) is a conference conducted to discuss the important opportunities and challenges that the Ontario aerospace industry is facing. In this conference, The Ontario aerospace is considered to be a nascent cluster in which all parts of it are present and capable of implementing a strong and competitive aerospace hub like the one in Montreal.

Several challenges are named by members of the conference in order to explain the steps that should be considered to proceed in building the Ontario aerospace hub. According to the presenters, there is a need for strategic planning by the provincial government and the federal level. The presenters called for an aggressive policy role that would go beyond effective tax structures and basics rights, as well as a national innovation strategy. They argued that creating clusters is not easy and networking should be promoted based on the same vision so that all companies, institutions and resources are all working in one direction. One problem in Ontario is that traditional market behavior still works against clusters (cooperation vs. competition). Moreover, Honeywell company in Ontario stated that the Ontario Aerospace Council is underfunded and collaboration is a must because of the long lifecycle of the products and the

[43] www.theoac.ca

expensive R&D, so OEMs are looking for tier one suppliers all down the chain to take the risk of product development. On the other hand, Bombardier called for considering the skill shortage issue when the average work age is 53 that is a real threat to aerospace industry, and that working on creating a growing workforce pool is a priority in facing aging populations.

6.5 Mexican initiative (PDP)

6.5.1 Mexican aerospace industry

"Mexico has established itself as a global leader in the aerospace sector" (ProMexico, 2013). According to the report done by ProMexico in 2013, there are 270 companies and support organizations located in the six states, which employed more than 31000 highly skilled workers. Mexican exports to the US in 2012 amounted to $5 billion dollars, and foreign direct investment in the sector was about 1300 million dollars U.S. There is also the proximity to the U.S. market of which Mexico is the sixth provider. The United Nations Development Program in Mexico adapted supplier development programs for Mexican context. In 2002 the supplier development program PDP "Programa de Desarrollo Proveedores" was being tested on five companies with their suppliers for modification according to results achieved. In 2007, the government of Mexico adopted the program and increased its budget to allow the participation of a greater number of companies and suppliers. The program's period is one year of work in each value chain (the buying company and its suppliers). Companies in Mexico have accepted to pay 30-50% of the cost of technical assistance received, and the federal or local governments, and sometimes big companies, fund part of cost. Objectives of this program show a clear intention to improve and develop suppliers in several industrial sectors such as energy, automobile, aerospace, food and many other industries (UNDP, 2008).

6.5.2 PDP-assessment summary

Table 6 presents the assessment summary for PDP. The first section discusses the SD factors important for the success of an SD initiative. As can be seen, one factor is not considered in PDP (continuous improvement). In fact, the program is implemented for one year which is a very short period compared to other initiatives (SC21, Mach, and CESD). Moreover, the program depends on one level improvement comparing to the other 3 and 5 level improvements. Section two is not included in table 5 since knowledge management elements we identified as crucial for improving KM activities are not present in PDP. The last section discusses only one out of the four main success features.

Table 6: PDP assessment summary

SD factors	
Top management involvement	UNDP and prime company
Supplier identification	Mentor support decided by the buying company
Cross functional involvement	The key players were: ministry of economy, developmental bank, industrial chamber, and UNDP office.
Supplier evaluation	Delivery Quality Service
Performance measurements	The program depends on performance measurements to evaluate supplier's performance but these measurements are not listed neither on the PDP document report nor through the implementation steps in El-Salvador supplier development program
Implementation	Training and on site visits
Continuous improvement	No continuous improvement, depends on one interruption time
Long term period	The period of the program is very short; 1 year period program
Specific aerospace features	
Technological and innovation capability programs	Technological projects were not present
Government financial funds	500 000 USD
Market coverage	1 prime company (Bombardier)
Cluster	No formal cluster exists

6.5.3 Effects

According to the UNDP (2008a), the results of the initiative for the year 2008 were good due to the number of companies certified and the extension of the program to other countries. In addition to 65 companies certified, 1,500 jobs were created with a substitution of imports of 10 million USD. Exports also increased by $114 million. After these results, the PDP was transferred to El Salvador because of the results had increased the competitiveness of the industry. In a report done by the UNDP about the transfer of the program to El Salvador (2008) , it was found that 80 % of SMEs which participated in it had reduced their cost, 78% had increased their efficiency, and 83% had created new customers beyond the anchor company. To test the effectiveness of the program on the aeronautical sector and the developments and improvements archived in the aerospace sector, I present one year (2008) of implementing this program in Mexico to assess the whole program, its methodology, implementation, and finally results achieved in this year.

6.5.4 Challenges

Since Mexico is achieving a high increase in growth rate in a short period (20% annually since 2004 according to FEMIA (2012), the challenge is to develop a national strategic supplier development initiative rather than implementing the basic models of the development program. The government and the industry should cooperate to create adequate collaborative and relational learning contexts that help in implementing more strategic and complex SD initiatives in the country. It is clear that they are planning to lay the foundation for identifying the gaps and opportunities in the supply chain and suppliers with the potential for development on a large scale (ProMexico, 2014) .

6.6 Conclusion

This section achieved the first purpose we identified for this thesis. It presents and discusses assessments of the success factors (SD factors, KM enablers, and the specific aerospace features) of five SD initiatives in the aerospace industry. We found that the SC21, Mach, CESD initiatives displayed all eight developmental factors while to the PDP initiative displayed only four. This indicates that the former three are strategic in nature while PDP is reactive. When it came to assessing KM enablers, again the SC21, Mach, CESD initiatives displayed all seven elements while the PDP displayed none. As for the success features, the Mach initiative showed evidence of the existence of all four features. SC21, CESD, and the PDP initiatives showed the features of technological and innovation capability, market coverage, and governmental funds, but were not implemented in clusters. When it came to Esprit, no assessment was performed as the initiative was still in its conceptual form. However, we did include an evaluation of the opportunities and challenges that face this initiative. In the following chapter we tackle the second purpose of this research and present a detailed comparison of the five SD initiatives.

7 Comparison and Discussion

The second research purpose of this thesis is to compare the five SD initiatives depending on the success factors identified in the literature review. This chapter starts by presenting a general comparison of the five initiatives followed by a comparison of SD factors, KM enablers, and specific aerospace features. This comparison relies on the assessment of initiatives using documentary analysis as well as the opinions of the interviewees using semi-structured interviews. The interviewees presented their perspectives on SD factors and comment on the differences between the factors of the five initiatives, all of which are identified and presented below.

7.1 General comparison

7.1.1 Types of supplier development initiatives

The two types of programs identified in the literature of the SD are *strategic* and *reactiv*e. Both of these programs involve buying companies in order to develop their suppliers. The table below presents which SD initiatives type is categorized by each program. This comparison will reveal whether the results accord with those presented in the literature review regarding the two types. .After analyzing four different SD initiatives in the previous chapter (SC21, Mach, CESD and PDP), two initiatives types were identified: strategic and reactive. In this table, the developmental stage of the country of the initiative (developed and developing) is stated, as well as the province or the region where each initiative is implemented, the owner of each initiative, the result of assessment of each initiative from the previous chapter.

Table 7: Ggeneral comparison ofamong the initiatives

Country	Province or region	SD initiative name	Owner of the SD initiative	Year initiated	Suppliers participated	Suppliers graduated	Assessment results	Strategic/ Reactive
United kingdom (Developed country	London	SC21	ADS (trade association)	2006	750	143	Success factors are present	Strategic
Canada (Developed country)	Quebec, Montreal	Mach	Aero Montreal (trade association)	2011	50	1	Success factors are present	Strategic
	Manitoba, Winnipeg	CESD	MAA and MAHRC (trade association)	2011	6	5	Success factors are present	Strategic
	Ontario	Esprit	OAC (trade association)	1993	NA	NA	NA	NA
Mexico (Developing country)	Mexico	PDP	UNDP (United Nations Development Program)	2008	60	60	Only five factors are present	Reactive

In this table, a relationship has been identified between the level of development of the country of the SD initiative (developed or developing) and the type of the initiative implemented (reactive or strategic). In developed countries (Canada and United Kingdom) where there exists a traditional aerospace industry, SD initiatives are more strategic. On the other hand, the SD initiative implemented in Mexico (a developing country) is more reactive. PDP is a short period program (1 year) which focuses more on improving suppliers than on more sophisticated skills. The UK and Canada have implemented a strategic type of SD for achieving outstanding performance which can lead them to globally compete.

7.1.2 The role of trade associations in the success of supplier development initiatives

Table 7 shows the relationship between the type of SD initiative and the owner of the initiative. It is concluded that trade associations mostly own the strategic SD initiatives. The initiatives

(SC21, Mach, CESD and Esprit) are all owned and managed by trade associations while the initiative implemented in Mexico (PDP) is managed by the UNDP.

Trade associations are found to play a very important and essential role in the success of the strategic initiatives' implementation. The trade association is where all the primes, suppliers, and players in the aerospace industry in a certain region, province, city, or country should gather under a common goal and vision. The trade association should come from the industry and present the voice of all the players in the industry and especially SMEs which are the main target of SD initiatives. Since the trade association is the owner of the SD initiative and responsible for implementing this initiative, the association has a big impact on the success of the SD initiative. When the trade association represents the voice of the industry including all the players and is not self-serving or exist for the sake of existing then we can say that it plays a very efficient role in the success of the SD initiative (Grades et al., 2015). Moreover, the importance of the role played by the trade association is seen in the effects and the achievements of the participants in the initiative. The more the results are clear and obvious to the public, the more efficient the role of the trade association will be. In the chapter of assessment, the results and achievements of each initiative are included in the effects section of each initiative. In ADS, the effects of the initiative are stated clearly in a report where each participant talks about his case and how SC21 aids in improving and developing its processes. Also included are YouTube videos about suppliers talking among themselves about the improvements gained from the SC21 program. Same for the MAA which is very clear about the results of the CESD initiative. Four cases of success are listed in their website that show how each participant developed through this initiative as well as the benchmark report that the leader of the CESD provided us to show the assessment scores of the company XYZ.

On the other hand, the document analysis done on the Aero Montréal association reveals the absence of the information about the effects that Mach initiative has on suppliers' performance. Moreover, several attempts performed in an aim to get information about Mach effects but with no result. Aero Montreal's management is responsible for showing the effect of the initiative on participants after 7 years since its initiation in 2011. In this case, the role of the trade association is very important in not only managing the initiative but also showing its effects. In this context, Dostaler says that:

> *"I can't see the strength of Aero Montreal in implementing Mach initiative without knowing information about suppliers achieving increase in production and sales, and new clients".*

Another expert states that:

> *Mach is a framework that is a step in the right direction, but it is very difficult to know if Mach is successful and Aero Montreal is achieving its goals because we don't have real information that proves the effects of the initiative on the suppliers. Aero Montreal takes funds from the government to implement the Mach initiative and it is our right to know all information about this initiative, implementation and effects. The success of the initiative is not measured by the number of the companies participating but by the quality of the improvement and development provided to those participants.*

These opinions show that the trade association plays very important role not only in the management of the initiative but also in revealing the effects and impacts of the initiative on the

participants. The comments of our interviewees insist on the importance of the Mach initiative but have many questions regarding the unavailability of its effects.

Table 7 also identifies a second kind of program owner where the owner is not a trade association. The United Nations Development Program (UNDP) is a united nation's global development network[56]. After the government took over the program, the implementation of the model was carried by the UNDP in Mexico. So, the PDP program implemented in 2008 (included in study) is supported by government but under the management of the UNDP office. Thus, the characteristics of the program's owner show that the management is not created from the industry since the country is a still developing and the aerospace sector needs to be governed and developed by big organizations.

7.1.3 The number of members of trade associations and that of participants in the initiative

In strategic SD initiatives there is a relationship between the number of suppliers and primes who are members in the trade association, and that of participants in the initiative. The greater the number of members of the trade association, the greater the number of suppliers included will be. This is due to the fact that the members of an association are favored when participants in SD initiatives are selected. Thus, when the number of members is high then the number of the participants in the initiative will be also high. Also, when the association includes a big number of players in the industry then the trade association is said to be the voice of the industry. Otherwise, the association will be dominated by the prime companies or by the SMEs which is not a good environment for building a successful initiative. One expert said that:

[56] www.undp.org

The trade association should contain primes, SMES and other players in the industry to be the voice of all participants and not only the voice of the primes or the voice of the SMEs.

Another expert states that:

It is nice to have more suppliers participating in the initiative but these programs depend on the participation of big companies who act as mentors. So, the number of suppliers depends on the number of mentors participating.

7.2 The role of supplier development factors

In the table below, the SD implementation steps are summarized for all initiatives participating in the study (except Esprit since it is still in the conceptual form). In this section, we will discuss the differences between factors of the different initiatives and show the opinions of interviewees regarding these differences.

Table 8: comparison of the SD factors of the initiatives

Steps	SC21	Mach	CESD	Esprit	PDP
Top management involvement	ADS	Aero Montreal	MAA & MAHRC	OAC	UNDP
Supplier identification	Mentor supported Self-supported	Mentor supported	Mentor supported	NA	Nomination by the mentor
Cross functional involvement	Specialized group	Working group	Specialized committee	NA	Not present
Supplier evaluation	4 processes	15 processes	11processess	NA	3 processes
Performance measurements	Rules and questionnaires	Common metrics	Benchmark reports	NA	Performance measures
Implementation	In site visits, training sessions and consulting companies services	In site visits and training	Listed number days for each implementation step	NA	Implementation present

Continuous improvement	3 level awards	5 level Mach	5 level program	NA	Not present
Long period	11 years	7 years	7 years	NA	1 year

7.2.1 Top management involvement

Top management involvement is the first step of SD implementation which is affected by the management of the trade association. The formation of committees, teams, and working groups for all initiatives is clear **(**Performance, Development and Quality Special Interest Group – PDQ SIG[59] in ADS; supplier development group in Mach; the CESD team in MAHRC). Also, the involvement of the management is clear in PDP programs from both the UNDP office and the anchor companies that invest both time and money aiming at developing its suppliers. While, the involvement of top management in PDP lasts for a very short period (1 year in case of PDP) less intense work of the management in the SD reactive programs is revealed.

7.2.2 Supplier identification

Supplier identification is very important and main step of the SD initiative. In SD programs implemented by buying companies to develop their suppliers, the process depends on identifying suppliers who provide the company with strategic products but who are not leaders in the field Thus, the buying company implements an SD program to be with a supplier in an ongoing developmental process in order to improve its competencies because of the important and continuous development of the product to its competitive advantage or by developing suppliers because there is a lack of high qualified suppliers to produce a certain products. When implementing SD initiatives within the industry, the supplier identification process is totally

[59] www.adsgroup.org.uk

different. The main goal of the SD initiative is to develop a greater number of suppliers especially small and medium enterprises. The SC21 identification process is open to all suppliers in which every supplier can participate in the program with no limits. Moreover, the process offers suppliers two choices: either to be a self-starter in which case the supplier can benefit from all the services of the program but without having mentoring from a prime company, or to be prime-supported, where the supplier chooses to be supported by a prime company in its developmental journey. In the Mach initiative, the process is totally different; suppliers apply each year to the intake period and the management of the initiative nominates a specific number of suppliers to participate in the program. The CESD initiative follows the same procedure as the Mach initiative in which the management chooses from suppliers who applied, and decides with the committee and the prime companies participating in the initiative, who will participate. The supplier identification step in the Mach and CESD initiatives are prime-supported in which the development process always links the participant (supplier) with a mentor (prime or OEM Company). In this context, Dostaler says that:

> *From the developmental perspective, the procedure that SC21 initiative uses to involve suppliers is better since it gives the opportunity to suppliers to participate without the aid of the mentor. The good and perfect development should come from within the company. In some cases, using a mentor to develop a supplier is not a good decision unless the supplier wants to be mentored by a prime company. The downside for the supplier is that often the supplier is locked into the relationship and whatever they learn from the OEM it will be knowledge specific to that OEM. It is better that small companies being free to do what they want and to own their success for themselves.*

Howard states that:

> *Companies should improve their own processes but an external evaluator is also very important. Talking about Micro pilot's experience in the CESD initiative, the CEO said that they are happy with CESD because they don't tell them how to work; instead they do the performance measures to let them see if the company is getting better. He said that companies should work on how to achieve the goals set by the initiative. In his opinion, SMEs should have their own developmental processes in addition to the external initiatives support and help. This will ensure development from within the supplier.*

In PDP, the identification of the suppliers is decided by the anchor company (buying company) which identifies the local suppliers it wishes to improve and develop (usually the local suppliers are its suppliers). The anchor company sometimes funds not only part of the cost but also the management and technical expert's time. This looks more like the development of the buying company to its suppliers but the difference in this case is that the UNDP office shares the management and the funds with the anchor company. This kind of program's management is not found in the other initiatives where the whole model and implementation is done by the trade association.

7.2.3 Cross-functional involvement

Cross-functional involvement is clear in SC21, Mach, and CESD (members of the initiative are listed on the website of each initiative). In strategic initiatives like SC21, Mach, CESD, and Esprit, the aeronautical companies share decisions with several players in the industry such as research centres, academic institutions, trade associations, training companies, consultants and

experts from the industry. The executive committees that are responsible for taking important decisions are stronger in SC21, Mach and CESD. In PDP, cross-functional involvement depends only on the UNDP office and the anchor company.

7.2.4 Supplier evaluation

The supplier evaluation process differs in the three strategic SD initiatives (SC21, MACH, CESD) in which each initiative improves the supplier. SC21 is also different from the Mach and the CESD initiatives in the supplier evaluation process. According to the framework and evaluation rules' brochures listed on the website of SC21, suppliers must achieve the minimum standards in delivery and quality performance for a rolling 12 month period in addition to business, manufacturing and relationship management model performance. It is clear that SC21 is more focused on surveying the applicant's customers regarding the delivery and quality data before validating the manufacturing and business assessments, and passing the final evaluation score. The Mach initiative does a supplier's evaluation depending on 11 processes and CESD on 9 processes. Kliewer, the leader of CESD initiative in Manitoba comments by:

> *"We have a problem now in evaluating the participant in the 9 processes and we are doing "Diet CESD" as he called it. Focusing on several processes needs a large amount of investment from the side of the initiative and the participant, and unstable funding from the government leads us always to decrease our developmental activities"*

Another expert comments on Mach Initiative by:

> *Mach is an excellence program that focus on developing SMEs and training them to scale up, but what is difficult in the program for SMEs is that there are*

several things to address at the same time such as operations, leadership, management, funding and access to infrastructure. Addressing all the processes at the same time is difficult. The best way is to focus on lower number of main processes because having shorter sets would be easier to follow implementation and monitor progress rather than having long sets with 11-15 processes.

In PDP, the program focuses more on delivery, quality and technical assistance to do the supplier evaluation. These are the variables that are used by the program to evaluate the participants. Suppliers were evaluated once in the last month of the year.

7.2.5 Performance measurement

For the performance measurement, SC21 is the only initiative that states all the rules related to quality and delivery that suppliers should depend on to improve and develop. In addition a complete tool kit for relationship management is uploaded on the website of the initiative. This toolkit contains a questionnaire and system for organizing and identifying the important suppliers and partners to the company. Also, better contract management and communication before and during the manufacturing process are stated to educate the companies about the benefits of these practices. CESD and Mach use specific rules to measure the performance of the participating suppliers but these rules are not stated in their implementation guides. One expert says that:

A formal system or rules should be created in cost, quality, delivery and innovation for measuring the performance of the participants periodically. The clarity and simplicity of these rules ease the implementation of the initiative by both the assessors and the participant company.

In the PDP program implemented in Mexico, to achieve the certification of PDP suppliers had to achieve improvements in quality, delivery and service through 1 level (12 months). This one level program reveals the reactive type of the program.

7.2.6 Implementation

The implementation process pursued by the CESD is the most organized and clear due to the statement of implementation of benchmark process, strategic business planning (SBP), and executive edge leadership academy (EELA) in addition to continuous training and academic sessions. Moreover, four cases of success about companies participated in CESD show the detailed implementation steps that are provided by consultants in the initiative to help suppliers improve certain processes. The SC21 initiative "considers that training is a key enabler to the successful deployment of SC21". An SC21 special interest group and steering board approved and assessed a number of training companies to offer suppliers training sessions related to several improvements. Mach initiative shows the importance of providing on-site visits and continuous training sessions to suppliers participating. In this context, Howard talks about the benchmark process that is conducted by CESD annually and depending on the result the company can decide the future plans for the required improvements. He says that:

> *The importance of the benchmark process used by CESD which is very effective, it takes place over a month (in 4 sessions) and includes an evaluation of the results and goal setting for the next year. Then a follow up process that happens once a month is done by the leader of the initiative.*

On the other hand, the implementation of the PDP program is only 3 months which clearly shows that the objective of the program is to develop very few issues with the supplier. This step

alone reveals the reactive type of the program. Once the implementation plan is finished, the anchor company has one month to identify the results and document them if it wants to involve other SMEs in this program.

7.2.7 Continuous improvement

SC21 is the best program in continuous improvement; there is a single improvement template called the "continuous sustainable improvement plan" (CSIP) to be used by all companies participating in the program in order to increase the operational improvement. The complete guide and a detailed Excel template are found in the implementation guide (ADS, 2014) for more information about all CSIP forms used by suppliers in the SC21 initiative. SC21 is a three levels initiative (gold, silver and bronze awards) in which the scores of delivery and quality increases for the higher level. Continuous improvement in a Mach initiative is due to the five levels of improvement in which suppliers are targeted. Suppliers must be in continuous improvement in order to attain higher levels of Mach cohorts. CESD also has an interesting continuous improvement plan that aids suppliers in proceeding from learner level to world class level supplier. CESD is using the strategic business planning for strategic vision (SBP) and the process confirmation exercise that is verified by the CESD management. The process confirmation process is done every 12 to 18 months; the initiative's committee follow up the improvement of each process with the supplier as well as the level of complexity of this process. The continuous improvement is not present in the PDP program since the program is reactive. Related to the continuous improvement factor, Roy says that:

> *In Mach initiative, participants have clear objectives to achieve from Mach 1 to Mach 5 in which it is a very good way for the companies to proceed. The*

continuous improvement using levels or cohorts is better because for the supplier to move from a lower to a higher level or cohort it should satisfy certain objectives related to the level.

7.2.8 Length of initiative

SC21 started working in 2006, the Mach initiative in 2011 and CESD in 2011. Eleven years of execution for SC21 shows the importance and continuity of the program with more than 1000 signatories and more than 200 suppliers with gold, silver, and bronze awards. The Mach initiative has 6 years of execution with one supplier in Mach 5 level and more than 50 suppliers in the other four levels of Mach. CESD has 6 years of execution with 5 suppliers completely developed and one supplier still in process. The period of the program is directly related to the number of participants and also to the effects of the initiative. The CEO of Micro Pilot company, Howard, states that:

The longer the period of the initiative the more efficient it will be and the more the clarity of its effects and success will be also. According to my experience in CESD initiative, participating for short period of time will not have any impact on the company's performance. This is very clear from the benchmarking of my company.

Another expert comments that:

The supplier's motivation for being in the program varies widely so if the company is committed and interested in this program it will find a way to improve its processes. It is very important to inform suppliers who want to

participate that SD initiative is a very robust program and it is not easy and the period to achieve the desired objectives is not short anymore.

The period of the program is the most important element that decides which type the SD program/initiative is. As opposed to the other strategic initiatives that range between 7 and 10 years periods, PDP is a 1 year program. Mexico is a developing country and the aerospace industry is not a traditional industry but it is growing quickly[61].

7.3 The role of knowledge management enablers

According to our theoretical review, knowledge management is said to enhance the SD activities and lead to an effective initiative. Collaboration, openness, teamwork, partnerships, connectedness, trust and many other terms are stated by all initiatives in their mission. The three initiatives' implementation demonstrates their promotion of all these actions which leads to higher levels of knowledge management and sharing.

Table 9: comparison of the KM enablers of the initiatives

Steps	SC21	Mach	CESD	PDP
Relational capital	Code of practice	Collaboration and openness	Collaboration and relationship	Not present
Asset specificity	TRA covers 75 % of cost and the participant covers the 25 %	Financial resources and services (the % of coverage is not stated in percentages)	Government covers 50 % And the participant covers the other 50%	UNDP office and the anchor company covers 60 % and the participant covers the 40 %
Geographical and cultural proximity	8 offices in UK and unity between trade associations	Same region and culture (Montreal)	Same region and culture (Manitoba)	Not present
Motivation # of participants	1000 participants	50 participants	6 participants	60 participants

[61] Mexico's Aerospace 2013

Management skills	Experienced management	Experienced management	Experienced management	Experienced management
Goal congruence	Common objective	Common objective	Common objective	Common objective
Formal and informal interaction	Events and gathering listed on website	465 events and about 145 projects in 2015	10 meetings per year	Not present

Roy says that:

> *The management skills in the SD initiative are needed to improve participants and support them in their excellence journey. A successful SD initiative depends on a few people who make all the effort required to make it effective and stimulate the participation of other companies.*

Kliewer says about knowledge management that:

> *"We are conducting several events over time to meet and network. As participants develop systems that are to some extent similar; they can see synergies between them and they could partner on different projects. Cooperation has started to happen between participants and the companies of past cohorts and current cohorts. To increase the knowledge between the suppliers and the prime companies and OEMs, we are actively engaging them with what packages of work they are looking to form out. Then, we get our suppliers to have a conversation with the large companies to identify what packages they want to put in the supply chain and what are the best matches for capabilities of companies to those needs. Working in the aerospace industry in the UK as a leadership consultant and trainer in several aerospace companies, I*

noticed from the companies there that many benefits came out after running the same SD imitative in UK. They said that companies have started networking with each other and realize their capabilities. After knowing each other, they were able to bid on the work together instead of none of them bidding on the work. That's what is slowly moving to Manitoba; we are building an environment of collaboration and cooperation between players and educating them on the necessity of working together".

7.4 The role of specific aerospace features

Table 10: comparison of specific aerospace features of the initiatives

Steps	SC21	Mach	CESD	Esprit	PDP
Technological and innovation capability	NATEP	SA2GE	Research centers	NA	Not present
Market coverage	10 primes	4 primes	1 prime	NA	1 prime
Government funds	The exact budget is not stated	15 million $	2 million $	NA	500000USD
Cluster	Not present	Montreal cluster	Not present	NA	Not present

7.4.1 Technological and innovation capability

Aeronautical features are considered by all initiatives which is very clear from their adopting standards and technological projects that foster the continuous sustainable best practices in the aerospace industry. SC21 implements both NADCAP and AS/EN91XX, Mach implements the SA2GE and CESD conduct several projects with research centres like IRAP and SRED[62]. PDP

[62] Industrial Research Assistance Program funded by government of Canada; Scientific Research and Experimental Development Tax Incentive Program

doesn't implement any projects to improve the technological and innovation capability since it is a reactive program and focus more on quality, delivery and service.

7.4.2 Market coverage

Market coverage is the necessity that suppliers should have connections and interaction with primes in order to market their products and gain contracts. Since the number of primes is specific, SD programs should try to build connections between primes and SMEs to foster an environment of collaboration and openness all players. In this way, the trade association which is the owner of the initiative is giving an opportunity for the supplier to show its capabilities, strength, and ability to contract with big companies to develop products and produce the best quality in the right time. SC21, Mach and CESD are trying to gather primes, integrators with SMEs and the other players in the industry, in order to foster relations between them. Roy says that:

> *Prime companies in the SD initiatives are very important in developing suppliers; the number of suppliers developed in the initiative depends on the number of the prime companies. The reason why the number of participants is small in the several initiatives where there are few prime companies.*

Kliewer explains several efforts initiated in the CESD initiative to increase the market coverage of the SMEs and help them to have access to governmental offers. He says that:

> *"It is a difficult for SMEs to connect with potential customers. In this context, we are working with companies that want to be able to identify what are the federal government procurement activities through DAG "Defence Acquisition Guide*

2016" [63]that show what the federal government is looking to purchase for the army and how much those contracts are worth. We are working with SMEs to help them identify what their core capabilities are and how these capabilities match up to the needs that have been identified by the DAG "speaking the language that OEM is more interested in".

7.4.3 Government funds

Government financial funds are very important and play a vital role in improving and developing suppliers to participate in the initiative. Almost all initiatives studied in this thesis don't offer any information about how funds are distributed among the initiative's implementation. The Mach initiative in Montreal got $15 million dollars over 5 years in funds from both private and public organizations, and lately in October 2016, the government of Quebec offered $14 million dollars in funds for implementing the second phase of the SA2GE technological program. Mach is getting funds from the three government levels. The information about how funds are used to implement the initiative is not clear. Noticeably, more than 50 suppliers are participating in the Mach initiative and benefiting from its services and support in improving their processes since 2011. For SC21, it was stated by ADS that regional trade associations are responsible for funding the SC21 program as well as government funds. We concluded that the funds come from the trade associations which are funded by its members and the prime companies. In the UK the government funds the more technological program "NATEP", for which it got a budget of £80

[63] http://www.forces.gc.ca/en/business-defence-acquisition-guide-2016/index.paige

million pounds[65]. A table shows the funding for SC21 participants in all trade associations. In this context, Roy says that:

> *Smaller companies cannot increase the performance so they can take the public funding that assists in the functioning of these programs. Government can provide some funding but also can motivate by informing companies about these initiatives. Government support is very important not only because of the resources but also because of the publicity they can disseminate about the program.*

Dostaler says that:

> *The innovation literature shows the importance of the government support and the R&D literature the important link and support among universities, companies, government. So it is all very good if all the stakeholders are going in the same direction. For an effective government support in such developmental programs, knowledgeable public civil servants should be employed to inform the government about the real needs of the SMEs in the industry.*

7.4.4 Cluster

The presence of a cluster in an SD initiative works as an enabler, according to our review about clusters. The review argued that clusters support much in achieving SD initiative's goals and objectives. The aerospace industry in the UK is characterized by the existence of aeronautical

[65]www.natep.org.uk

offices spread out in different regions in and outside the UK, more than clusters. For example: the ADS group, the trade association responsible for SC21, has more than 7 offices in the UK (London, Frangbourgh, Scotland) and outside (India and Japan). There are 5 trade associations in which each one is responsible for managing the same supplier development program and the technological program in its region. They focus more on promoting relationships between members of the association and also between the associations themselves. SC21 is the same program implemented in the five regions of the UK and the technological program NATEP is also used by the five trade associations in different regions in the UK.

The Montreal aerospace cluster that characterizes the Mach initiative is very important for the success of the initiative as it enables interaction and collaboration between all players in the sector. In this context, Dostaler talked about her worries from the existence of several trade associations in the Montreal aerospace cluster. She states that

> *The presence of several associations in the aerospace sector in the province of Quebec such as: AQA, Aero Montreal, AIAC, CRIAQ and CARIC has several limits on the aerospace sector. Having several trade associations will lead to an unhealthy competitive behaviour between players and the environment will not be good for collaboration and openness. Each association has its goals and vision which will lead each group of companies to act in different ways. Also, governmental funds will be divided among several associations instead of one association. In this way, benefit from services and financial funds offered by any SD initiative will decrease.*

In Manitoba there are two sister companies (MAA and MAHRC) who claim that they are the voice of the Manitoba aerospace sector. The MAA composed about 90% of companies, which shows the healthy environment of the aerospace sector in Manitoba. In the website MAA, they claimed that the initiative CESD aims at developing suppliers and strengthening the aerospace sector that in turn will strengthen the cluster in Manitoba.

In Ontario, the aerospace sector is considered a nascent cluster since all pieces of the puzzle are there. Thus, the Ontario aerospace council should rather promote the relationship and communication between participants in the sector and provide them with the required technical skills and financial funds. In this way, OAC can create a competitive aerospace hub in Ontario which can gradually transform into an active and strong cluster by the unity of its players and their common goals. OAC is composed of 57% of companies in Ontario which shows that the association can work more on increasing the number of its members. Doing so is like paving the way for an organic and effective cluster. One expert says that:

> *The more performing the cluster, the better of the industry; there is a correlation between the two. Clusters in Montreal, France, they have very important roles; they get the companies together, close to the industry and the people know each other very well. They are credible when it comes to developing initiatives programs and attract the government to fund the industry.*

Another expert says that:

> *Clusters should be developed naturally, you cannot force it and there is interesting literature on clusters and their importance in the increasing the*

competitiveness of the industry. The most you can do is see it coming and nurture it and create the necessary conditions for it to continue growing. Relationships between players in the cluster should be truthful, genuine and not false friendship which will lead to true relationships, open communication and trust.

Regarding the aerospace features in the PDP program, technological and innovation capability, market coverage and clusters are all not important factors to the reactive program implemented in Mexico. Suppliers are still on the level of learning technical and operational skills that makes the program very simple, straightforward, short and less expensive. I only included one supplier development program done in a developing country in the aerospace industry in this thesis because this kind of developmental program started to emerge recently. Although several countries have started to appear with important production skills in the aerospace industry, they are still in the crawling steps which they require many developmental activities and efforts before implementing strategic SD initiatives. The program PDP is implemented in several industries in Mexico including the aerospace sector in which it accomplishes effective results and certified aeronautical companies. Thus, the analysis of this kind of developmental programs depended on the SDP model implemented in Mexico.

7.5 Conclusion

According to documentary research and semi-structured interviews, the SD in the aerospace industry is crucial and effective for both the SMEs, OEMs and industry. Presenting a general comparison between initiatives shows the existence of the two types of the SD initiatives (strategic and reactive), the important role of the trade association and the number of members in

the trade association in the success of the strategic initiative. The discussion of SD successful factors shows the opinions of the experts related to these factors and its implementation.

The discussion also interrogates the KM enablers promoted by the initiatives. SC21, Mach and CESD are found to promote all KM enablers despite the fact that activities differ from one initiative to another but all work on creating an environment of collaboration and openness. Specific aerospace features also are found to be important in both the initiatives analyzed and opinions of the experts interviewed. We conclude that SD successful factors, KM enablers and the specific aerospace features are important for building a successful SD initiative. In the next chapter, I will build on the discussion from this chapter to form recommendations and conclusion regarding SD initiatives in the aerospace industry.

8 Recommendations and Conclusion

This chapter provides recommendations that have been made from the assessment and comparison in the previous chapters. These recommendations contain several suggestions for the owners of SD initiatives, governments and policy makers. Since all the interviewees who participated in the research are experts in the Canadian aerospace industry, I depend on both the documentary analysis and the semi structured interviews done in the assessment and comparison chapters to identify key recommendations, especially to the Canadian National Supplier development program, OAC trade association (Esprit initiative). Then, a general conclusion is presented followed by the limitations of the research.

8.1 Recommendations

Recommendation #1: Better understanding of the role of the owner of the initiative (which in the current case is the trade association)

This thesis shows the important role of the trade association in managing the implementation of the initiative. Results show that these associations should be trustworthy and responsible in order to be able to improve SMEs and build an environment of collaboration and openness between participants in the initiative. The trade association should be the voice of the industry which contains a large number of SMEs in the case of the aerospace industry. SMEs are the "bulk of the industry" so the association should better understand the SMEs weaknesses and needs in order to provide them with the required help and funds. Moreover, it should educate companies about the importance of development and improvement that starts from within the company. The

greater the management skills of the trade association, the more members will be motivated to work under its umbrella and become involved in its development programs.

Recommendation #2: Better understanding of SD success factors

The management of the initiative should consider the success factors assessed and compared in this thesis. Identifying suppliers should depend on two options: mentor-support and self-support. Management should focus on fewer processes to improve and develop suppliers in the journey toward excellence. There is a need for better understanding of performance measurements rules that should be clear and simple so that companies can apply them smoothly. The clearness and simplicity of the rules of delivery, quality and relational management questionnaires motivate participants to involve and benefit from all the services of the initiative. Implementing initiatives should help companies in solving their problems and developing their processes, not to make their businesses more difficult to manage. The creation of implementation plans such as the bench mark process, strategic business planning process, and executive edge leadership academy lead to the effective improvements of participants. Using the code of practice to enhance the knowledge management activities and the relationships between participants is also very important in implementing a SD initiative. So, implementation steps can be tailored according to the needs of the SMEs and be creative in any way that benefits the participating companies.

Recommendation #3: Need knowledgeable policy makers who can assist in the implementation of SD initiatives and in turn the industry

Policy makers can play a very important role in providing information and knowledge to participants in initiatives, and for the industry as a whole. All our interviewees asserted the importance of the role of knowledgeable policy makers who can collect crucial information

related to the expected amount of aircraft that are going to be sold. Knowledgeable agents can be a foothold in other countries by setting up satellite offices where there is a demand for aircraft so that these agents can gather knowledge about buying plans, and at the same time help Canadian companies with information about the demand and kind of packages needed globally. Policy maker's role is to focus on global opportunities that benefit the aerospace industry. Moreover, they should focus on the emergence of new standards and regulations which if not considered by suppliers could lead to the loss of contracts and in turn clients in the global industry.

***Recommendation #4: Need for initiation a strong Canadian National Supplier development* program**

Creating a National Supplier Development Program (NSDP) in the aerospace industry in Canada is very important. Our suggestion is to create an NSDP that fits the needs of all prime companies all over the world so that suppliers developed in this initiative will have the opportunity to compete in the global market. Mach initiative is built by Aero Montreal on rules that satisfy the needs of the prime companies and OEMs in the Montreal cluster. Implementing such program in other provinces like Manitoba could negatively affect suppliers because they are producing for companies like Airbus and Boeing. Aerospace industries association of Canada (AIAC) is nominated by the experts interviewed as the association that could manage the national program in all regions of Canada because of its direct communication with the federal government. Looking at the difference between the UK aerospace trade associations and the Canadian aerospace associations, the five trade associations in the UK are implementing the same supplier development program SC21, and the same technological project NATEP, aiming to develop the participants depending on the same rules, assessment methods and performance measurements. The five associations work under the umbrella of ADS group, the premier association in the UK.

It is very clear that the cooperation and unity of all the associations led to the superior effects of both the SD program and the technological project. In Canada, there are three formal trade associations (Aero Montreal, MAA and MAHRC, and OAC) in which each trade association is implementing different SD initiatives and different technological programs. Moreover, it is clear that tensions between the provinces led each initiative to work toward different goals and objectives. The collaboration between the aerospace companies in different provinces in Canada will benefit from sharing knowledge and working on the creation of new and innovative production ideas for the aerospace industry.

Recommendation #5: Recommendations to the OAC trade association responsible for building the Esprit initiative

OAC can benefit from the findings to see how they can modify the structure of the Esprit program in several SD factors, KM enablers and aerospace features. For example, Esprit initiative considers 10 processes to evaluate suppliers that are considered to be very difficult and need a lot of investment. Our suggestion is that OAC should start by evaluating participants depending on prioritized processes that will lead to quick and better improvements in the capabilities of the participants. OAC should create an environment that expands cooperation and support between companies and especially SMEs. This will lead to a better understanding of the benefits and positive impacts that will be generated when all the players in the industry work on common goals and objectives. Relational excellence kit used in SC21 initiative is a very good kit related to better understanding of how to organize, manage, and enhance the relationships with partners in which a complete assessment done in several knowledge related activities for each supplier. Creating an environment that is able to nurture spontaneous and trustful relationships between players in the industry is the only way to develop real collaboration within

the cluster. Clusters cannot be created by associations, rather they have to be seeded and grown organically with attention over time because creating a cluster is like "pulling a flower from the soil" (Dostaler).

Recommendation #6: Need the support of Canadian government to the aerospace industry due to its global importance

The supplier development initiatives as well as other developmental programs are very important in the aerospace industry. The Federal government supports the development of technology but also manufacturing development should be supported for companies to remain cost effective. Inter-provincial tensions must be eased by the federal government due to its negative effect on the Canadian industry as a whole. The government should start with public schools to provide programs for the development of the future workforce for the aerospace industry. There is a need for serious commitment of the government to the aerospace sector so that Canada can represent the sector globally. Government levels should increase the support for the SMEs and suppliers in the aerospace industry. As a first move, government should initiate funding programs to help SMEs in having the necessary equipment and software that OEMs and big aeronautical companies have. Moreover, government should create special groups responsible for doing the necessary research about the federal and provincial funding in order to distribute the funds according to the needs.

8.2 General conclusion

This study describes the actual state of the aerospace industry towards implementation of Supplier Development initiatives, by identifying several factors that are important in creating a successful SD initiative. In addition to the assessment and comparison of the success factors of

five different SD initiatives that lead to several findings and recommendations. By conducting a documentary analysis on five SD initiatives implemented in Canada (Quebec, Ontario, Manitoba), the United Kingdom, and Mexico, and interviewing five Canadian experts knowledgeable on the topic of SD in the aerospace industry, this study gathered enough information to draw some results and to make recommendations to the owners of initiatives, governments, especially the Canadian government, policy makers and the OAC.

Results show the importance of the role of the trade association in implementing a successful initiative and demonstrating real improvements on the participating suppliers. Results show also the importance of better understanding the role of the success factors in implementing a SD initiative. In fact, SD factors, KM enablers, and specific aerospace features are found to be very crucial in the success of SD initiative. Analyzing three initiatives implemented in Canada in three different provinces shed light on the need for a national supplier development program that can unite the whole industry and create a kind of collaboration between the players of all provinces. But following these observations, the following recommendations have been presented:

- Better understanding of the role of the owner of the initiative (in the current case is the trade association)

- Better understanding of SD success factors

- Need knowledgeable policy makers who can benefit the implementation of SD initiatives and in turn the industry

- Need for initiation of a strong Canadian National Supplier development program

- Recommendations to the OAC trade association responsible for implementing the Esprit initiative

- Need for the support of Canadian government to the aerospace industry due to its global importance

For SD initiatives, results reveal the importance of all success factors that if considered in implementing a SD initiative could lead to superior results both on the level of SMEs and the industry. Moreover, players in industry (prime companies, OEMs, trade associations, government agencies and associations, universities and research centers) have to work together even if their interests are different. The end goal is the same for everyone: improving SMEs capabilities and profitability, which will lead to improve the industry as a whole.

8.3 Limits of the research

Considering it is an exploratory study, this M.Sc. thesis provides a broad overview of the actual state of the SD in the aerospace industry and shows a detailed picture of the SD initiatives implemented in Canada. This thesis was conducted using public information for the documentary analysis. However, future research can be done involving not only public information but also industry information provided by people who directly participated in SD initiatives. For example, suppliers and mentors themselves should be contacted and interviewed personally, rather than enduring the limitations currently in place. For example, suppliers and mentors themselves should be contacted and interviewed personally, rather than enduring the limitations currently in place. The current thesis was conducted using qualitative analysis which depends on documentary analysis supported by semi-structured interviews from experts in the Canadian industry. However, it does not provide any quantitative analysis related to the elements tackled in

the analysis. Due to the lack of research about SD initiatives in the aerospace industry, this study could be taken as a starting point and this kind of work could be undertaken in the near future by another researcher or players in the industry. Thus, future researchers must go further towards finding insiders and collecting more sensitive information that will give more detail about these programs. The data on initiatives provided in the context of this study is from the documents and reports related to the trade association which managed the initiative, aerospace journals, and public reports. In the future, new research can tackle these initiatives by collecting data through surveys distributed on participants of initiatives in which participants (suppliers) can answer questions related to the success factors studied in the current thesis.

Finally, the topics and concerns brought up in this study are directly related to SD initiatives in the aerospace industry. Many other interesting SD-related topics, such as manufacturing and engineering properties, reducing cost strategies implemented within SD initiatives, differences between SDs done by private companies and SD initiatives funded by government, the impact of these initiatives on the industry as a whole by conducting quantitative analysis on the real revenues, sales and number of clients achieved, are not covered in this study and should be addressed in another study.

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Appendix 1

Interview questions

Questions:

1. Have you been involved in supplier development? How? Could you give me some examples of supplier development activities?
2. Why do firms develop their suppliers?
3. Is supplier development important in the aerospace industry?
4. Did you know some supplier development initiatives in the aerospace industry?
5. What are the impacts of supplier development initiatives on the industry's performance?

In Canada, there are three aerospace Supplier Development initiatives implemented in different provinces (The Aerospace Review, 2012).

1. Why are supplier development initiatives widely implemented in the aerospace industry?
2. As an expert in the field, how do you see the effects of such developmental initiatives on the suppliers, the sponsors, and the industry?
3. How would you characterize a "successful" supplier development initiative?
4. According to your experience in this field, what are the most important elements that should be considered in SD initiatives?
5. How do these elements affect the initiative's success:
    a. Period of the initiative
    b. Funds of the initiative
    c. Owner of the initiative (buying company, cluster organization, public organization, and private organization)
    d. Steps of implementation (top management involvement, evaluations and assessments, implementation (visits and training sessions), and continuous improvement)
    e. Number of suppliers and mentors participated
6. How does the government's support affect the success of the SD initiative?

There are many clusters in the aerospace industry.

1. To what extent do clusters affect the initiative's success and in turn the industry's performance?
2. In your opinion, what are the most important elements in clusters that affect the success of the initiative?
3. How do the clusters' characteristics (age, funds, owner, and framework) affect the implementation of the SD program?

The aerospace industry is global and high tech (depends on technology and innovation pace). In a study about SMEs in the Canadian aerospace industry, SMEs are found to lack the technological capability and marketing coverage to be able to compete in the global world.

1. What are the current challenges that Canadian SMEs face in the industry?
2. Are there any areas or features that should be considered by the initiative when applied in the aerospace industry?
3. Why are technological and innovation capabilities considered to be important elements in the industry?
4. As an expert in this field, why do SMEs in Canadian clusters lack the recognition of international OEMs?
5. What are the most important elements (variables) that the owner of the Supplier Development program should focus?
6. What is the main difference in implementing SD activities within the cluster and private companies?
7. Who is followed through more effectively after the SD program is finished: the supplier in the cluster or private company?
8. Name cases of success and cases of less success.(SD initiatives or SD programs within buying companies in the aerospace industry)

Appendix 2

CONSENT FORM

1. Information on the research project
You have been invited to participate in the following research project:

Supplier Development initiatives in the Aerospace Industry

This project is being conducted by:

Supervisor:
Claudia Rebolledo
Tel.: 514-340-6928
Email: claudia.rebolledo@hec.ca

Address:HEC Montreal, 3000 chemin cote saint Catherine, Montreal,QC,Canada,H3T 2A7

Master's student, HEC Montréal:
Amne Samhat
Tel.: 514-xxx-xxxx
Email: amne.samhat@hec.ca

Address: 701-2600 Boul Thimens, Saint Laurent,QC, Canada, H4R2L2.

Objectives:

Specifically, this study aims at:

1. Identifying the success factors that SD program in aerospace industry should consider and focus on to implement an effective SD initiative
2. To assess and compare five supplier development initiatives done in different countries in aerospace industry.

2. Research ethics considerations

Your participation in this research project is strictly voluntary. You have the right to refuse to answer any of the questions. In addition, you may ask to end the interview at any time, in which case the researcher would be prohibited from using the information gathered.
HEC Montréal's Research Ethics Board has determined that the data collection related to this project meets the ethics standards for research involving humans. If you have any questions related to ethics, please contact the REB secretariat at (514) 340-6051 or by email at cer@hec.ca. Do not hesitate to ask the researcher any questions you might have.

3. Confidentiality of personal information gathered

You should feel free to answer the questions frankly. The researcher, as well as all other members of the research team, if applicable, undertake to protect the personal information obtained by ensuring the protection and security of the data gathered from participants, by keeping all recordings in a secure location, by discussing the confidential information obtained from participants only with the members of the research team and by refraining from using in any manner data or information that a participant has explicitly requested be excluded from the research.

Furthermore, the researchers undertake not to use the data gathered during this project for any purpose other than that intended, unless approved by HEC Montréal's Research Ethics Board. **Please note that by consenting to participate in this research project, you also consent that the data gathered may**

be used for future research projects, subject to approval of any such projects by HEC Montréal's Research Ethics Board.

All persons who may have access to the content of your interview, as well as the person in charge of transcribing the interview, have signed a confidentiality agreement.

4. Protection of personal information in the publication of research results
The information that you provide will be used to produce a document that will be made public. Although the raw information will remain confidential, the researcher will use this information in the work submitted for publication. It is up to you to indicate the level of protection of your personal information that you would like with regard to the publication of the research results.

-
- **Level of confidentiality**

Option 1:

☐ **I give my consent for my name to be disclosed in the dissemination of the research results.**

If you check this box, the researchers can quote you from your interview and mention your name in any documents or research articles produced following this study. You should not expect your anonymity to be protected in this case.

Option 2:

☐ **I do not want my name to appear in the dissemination of the research results.**

If you check this box, no information concerning your name will be disclosed in the dissemination of the research results. Consequently, your anonymity will be protected.

- **Consent for audio recording of the interview:**

☐ **I give my consent for the researcher to make an audio recording of this interview.**

☐ **I do not give my consent for the researcher to make an audio recording of this interview.**

You can signify your consent either with your signature, by email or verbally at the beginning of the interview.

PARTICIPANT'S SIGNATURE:

First and last name:
_____

Signature: _____ Date (dd/mm/yyyy): _____

RESEARCHER'S SIGNATURE:

First and last name: Amne Samhat _____

Signature: _____Amne Samhat_____ Date (dd/mm/yyyy): _____

Appendix 3

Competitive Edge Supplier Development Program Benchmark Report

Company Name:	**XYZ Corp**
Date of Benchmark Visit:	**19 Oct 2016**
Benchmark Team:	**Assessor A**
	Assessor B

File Name: A3-10 Benchmark Report: XYZ Org; Oct 2016
Created: March 28, 2013
Revised: May 21, 2013
Form Number: A3-10

MANITOBA AEROSPACE

COMPETITIVE EDGE SUPPLIER DEVELOPMENT PROGRAM
COMPETING ON THE GLOBAL STAGE

Scoring Summary (Numerical)

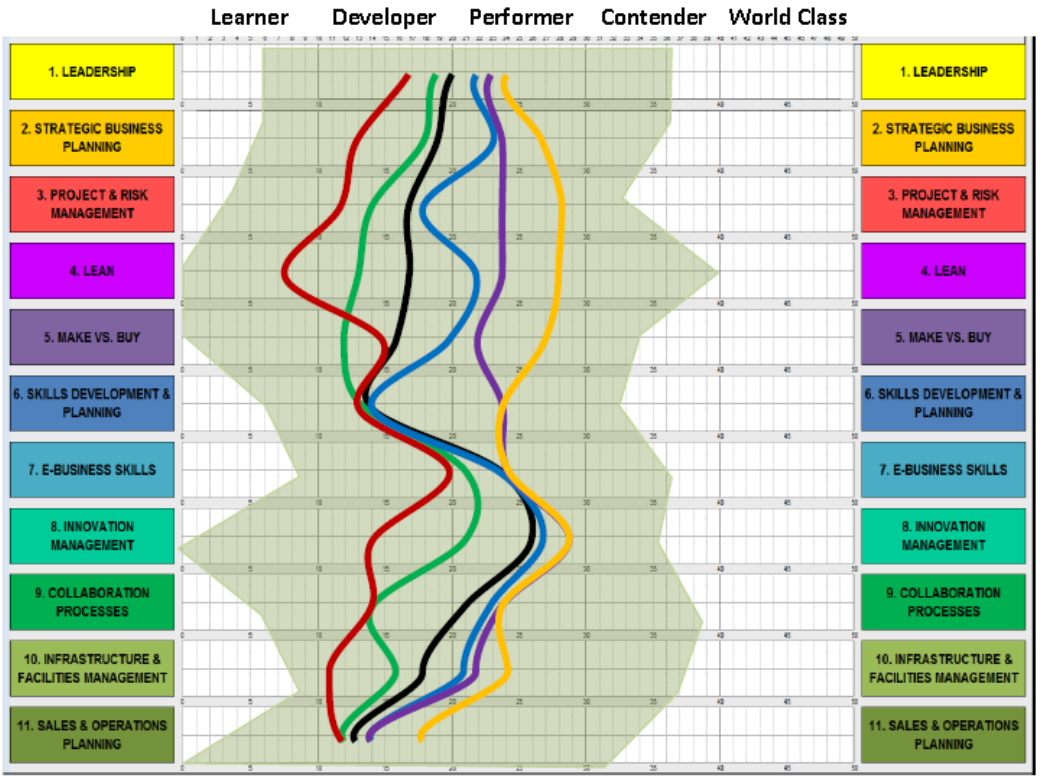
Foundation Process		Score BM1	Score BM2	Score BM3	Score BM4	Score BM5	Score BM6
1	Leadership	17	19	20	22	23	24
2	Strategic Business Planning	13	18	19	23	24	27
3	Project and Risk Management	12	14	17	18	24	28
4	Lean	8	13	17	22	24	28
5	Make vs. Buy	15	12	16	20	22	27
6	Skills Planning	13	13	14	14	24	24
7	E-Business	20	21	24	24	24	24
8	Innovation	14	21	26	27	29	29
9	Collaboration	14	14	21	23	24	24
10	Infrastructure	11	16	18	21	22	24
11	Sales and Operations Planning	12	12	13	14	14	18
	TOTAL SCORES	149	173	205	228	254	277
	AVERAGE SCORES	13.5	15.7	18.6	20.7	23.1	25.2

File Name: A3-10 Benchmark Report: XYZ Org; Oct 2016
Created: March 28, 2013
Revised: May 21, 2013
Form Number: A3-10

MANITOBA AEROSPACE

COMPETITIVE EDGE SUPPLIER DEVELOPMENT PROGRAM
COMPETING ON THE GLOBAL STAGE

Scoring Summary



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