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PRODUCTION PLANNING & CONTROL, 2016
http://dx.doi.org/10.1080/09537287.2016.1268274

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Strategic and operational considerations for the Extended Enterprise: insights from the aerospace industry

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ABSTRACT

The extended enterprise (EE) paradigm has been adopted in the civil aerospace industry to enhance collaboration and product innovation among supply chain partners. Nevertheless, key aspects of this collaborative form remain poorly understood. In particular, the interrelation of strategic and operational considerations has received little attention in the literature. Our study aimed to investigate this area, using two dyads as case studies, where three companies were involved in an EE form of collaboration. The primary case company was a leading manufacturer in the civil aerospace industry that employs EE principles on both upstream and downstream sides of its supply chain. The other two case companies were key suppliers embedded in the EE. This paper aimed to develop a more complete understanding of how sharing risks and rewards results in effective collaboration among EE partners with key strategic and operational results.

ARTICLE HISTORY
Received 18 September 2012
Accepted 13 October 2016

KEYWORDS
Extended Enterprise; supply chain management; operational effectiveness; strategy

1. Introduction

The term extended enterprise (EE) has become popular to identify the concept of an innovative and highly partnered, hence strategic, supply chain (SC) form (e.g. Braziotis and Tannock 2011; Spekman and Davis 2016). Supply chain management (SCM) has an ever-increasing importance. In many industries, the nature of competition itself has not only evolved towards competition between SCs (Lambert and Cooper 2000; Rice and Hoppe 2001), but rather between extended manufacturing enterprises (Maloni and Benton 2000; Mansouri, Ganguly, and Mostashari 2011). Typical examples include industries where high technology and product development costs and risk are involved, such as the shipbuilding (e.g. Lehtinen and Ahola 2010) and the aerospace industry (e.g. Braziotis and Tannock 2011). The concept of the EE has also been identified and researched in service industries, such as transportation networks (Mansouri, Ganguly, and Mostashari 2011).

The EE paradigm takes SC integration to the next level by incorporating a very long-term and strategic perspective. It is comprised of member organisations that strategically combine their core competencies and capabilities to create a distinct, new competency that best serves the individual target market (Bititci et al. 2004; Daugherty et al. 2006). The EE process embeds the suppliers via risks and reward agreements into a single SC-wide business model around the focal organisations. Due to the level of integration, and in order to remain competitive in the future, the relationships and outcomes are not only analysed and managed on a B2B level, but rather on the chain level as a whole (Spekman and Davis 2016). Therefore, it has been argued that the EE creates customer value in ways that are mutually beneficial for all SC partners (Spekman and Davis 2004).

Previous research has stressed that SC decisions should be strategic and aligned with a company's business strategic positioning and capability (Kim 2006). Many authors have considered SC integration as an essential strategic tool for competitive advantage. For instance, Davis and Spekman (2004) argued that, although global networks are complex, their coordination constitutes a source of competitive advantage. Upstream and downstream integration has emerged as an important element of manufacturing strategy and evidence suggests that the most successful companies are those that have effectively integrated business processes with suppliers and customers. For instance, Toyota and Honda have been known to have fostered collaborative relationships with suppliers and have traditionally performed better than their competitors (Spekman and Davis 2016).

The aerospace manufacturing industry, one of the most highly competitive and regulated global industries, must develop business models to manage the high cost and risk involved in the development of high-technology products, the long lifespan of these products and the cyclical, dynamic global market situation (Platzer 2009). Benefiting from strong barriers to entry, aerospace companies require a powerful collaborative framework that will enable them to work with their supplying partners to design, build, ship, install and maintain products to meet customer needs (Johansson et al. 2011). Fan et al. (2000) concluded that the aerospace original equipment manufacturers (OEMs) were no longer vertically integrated companies: suppliers were found to be fulfilling wider roles and taking greater responsibility, typically

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providing around 70% of an OEM's product. Clearly, therefore, meeting customer needs and improving the products extend beyond company boundaries. In recent years, aerospace manufacturers have moved beyond simple SC partnering, and adopted the EE as a solution to these demands, typically sharing both risks and rewards (Braziotis and Tannock 2011).

Although many previous researchers have described the way in which an integrated SC can result in strategic benefits for the participant organisations (Cai et al. 2016; Wong, Boon-Itt, and Wong 2011), there has been little focus on describing effects specific to the EE, and the challenges that this new paradigm creates for participant organisations in terms of both operations and strategic decision-making (Spekman and Davis 2016). Our paper aims to address this gap, and describes how operational effectiveness (OE) considerations within the EE can be closely related to strategic positioning in the aerospace industry. We aim to contribute to the debate on the development of strategic capability based on the EE paradigm. In the EE context, our research question was: 'How do Business Strategy, SCM and OE approaches interrelate?' In particular, by examining two dyads, we describe how the EE can have a positive effect on the way a company differentiates and successfully positions itself to cope with competitive forces. The following section presents the literature review on the EE, as well as on strategy and competitive advantage. This will be followed by a description of the methodology and case companies and the case analysis and propositions, followed by a discussion and conclusions.

2. Literature review

2.1. The Extended Enterprise

In order to offer a distinctive and innovative value proposition to the final customer and to compete more effectively on a global scale, it is increasingly important for members of a SC to work collaboratively in terms of aligning their production processes, as well as their strategies (Ramanathan and Gunasekaran 2014; Soosay and Hyland 2015; Soosay, Hyland, and Ferrer 2008). Supply chain quality management is an important emerging theme in Operations Management (Foster 2008) and much attention is paid to the improvement of business processes across the SC, as well as within the individual company. Although the direct link between SC collaboration and significant performance improvement has been disputed (Vereecke and Muylle 2006), the vast majority of the literature suggests that effective SC collaboration has a positive impact on operations efficiency and substantial value creation, reducing costs and enhancing competitiveness (e.g. Cao and Zhang 2011; Fawcett et al. 2015).

From the initial conception of the term SC and the debate about its management, a significant body of literature has explored avenues and implications of collaboration and partnership configurations among SC members. Developing SC collaborative relationships allows companies to integrate with their key suppliers in order to improve the effectiveness of key processes (Soosay and Hyland 2015). Although the term 'extended enterprise' appeared before the 1990s (Von Glinow and Teagarden 1988), the conception of what we regard today as an EE is typically attributed to Chrysler Corporation. The company used the term to describe extended relationships aiming to achieve specific benefits (Ericksen and Suri 2001; Tonchia 2004). This was a modified adaptation of the Japanese *keiretsu* model (Dyer 2000; Handfield and Bechtel 2002), which refers to Japanese company consortia that collaborate in partnership fashion (Dedoussis 2001), and involves joint ownership and control, as well as high levels of commitment, dependency and strategic coordination (Cooper and Ellram 1993).

The EE concept moves far beyond traditional company exchanges based on transactional relationships (Jagdev and Thoben 2001). The EE has been recently defined as 'a set of collaborating companies who openly share their operational capabilities and intellectual property to generate high-value products that meet and/or exceed customer expectations' (Saban 2014, 130). Therefore, the focus of the EE is on value generation vis-à-vis a sharing relationship among SC members from the design, to manufacture and to after sales support of the product, generating actionable knowledge for operational improvement for the participating organisations and the network as a whole (Folan and Browne 2005; Mendikoa et al. 2008). It essentially constitutes a 'value-oriented configuration that integrates the business relationships of companies with their suppliers and partners' (Margherita and Secundo 2011, 177). A distinctive characteristic of the EE, as opposed to traditional integration approaches, is the role of a focal organisation that 'connects the relevant business-unit processes of its suppliers with its own business-unit processes to maximize the value of the supply chain's output for its customer' (Bobbink, Hartmann, and Dewulf 2016, 2). It is a process that combines business relationships along supplier tiers with the aim to maximise product development effectiveness, reduce cycle time, minimise total system costs of the system and enhance quality and customer satisfaction (Margherita and Secundo 2011; Spekman and Davis 2016).

The EE is not an alternative to SC collaboration, but an advanced form of collaborative integration which focuses on innovation and information sharing (Spekman and Davis 2016), emphasising commitment, hence the need for established structures and processes for operations, technology and governance (Owen et al. 2008), in order to secure the long-term success of the product value chain. The mutual dependency is enhanced by the focal organisation outsourcing non-core activities to partnered organisations, and by the introduction of long-term contractual relationships that increase the chances of success in the product development and aftermarket phases (Braziotis and Tannock 2011; Browne and Zhang 1999).

The EE is predominately a knowledge-based organisation (Alguezaui and Filieri 2014; Braziotis and Tannock 2011; Kinder 2003; Spekman and Davis 2016; Tonchia 2004), supported by information and communication technologies (ICT) that contribute to minimising the negative implications of geographical remoteness (Braziotis and Tannock 2011; Davis and O'Sullivan 1999). Among the typical EE characteristics addressed in the relevant literature is the end-to-end perspective and management of all companies involved in the development of a product, typically by sharing risks and rewards, aiming to enhance the competitive capability of the participants and the EE as a whole, with particular focus on sharing knowledge and expertise. As such, it has been typically seen as a difficult paradigm to apply and operate (Childe 1998). Table 1 below indicates the typical characteristics attributed to the EE, while past research has elaborated on the distinctive characteristics of the EE to other typical bilateral relationships (see,

Table 1. Typical characteristics of the EE.

Scope: *Global*	
Extent: *An advanced form of SC, focusing on a holistic, end-to-end approach to management for all the partnered members involved – stable organisation among participants*	e.g. O'Neil and Sackett (1994)
Focus: *On the product value chain and established responsibility for the entire product life cycle – typically, the partnership is managed by the manufacturer (risks and rewards)*	e.g. Sehdev et al. (1995), Browne, Hunt, and Zhang (1999), Browne and Zhang (1999), Davis and Spekman (2004), Folan and Browne (2005)
Aims: *Enhanced competitive capability, aiming to manage and innovate in products and processes*	e.g. Browne, Sackett, and Wortmann 1995; Browne, Hunt, and Zhang (1999), Browne and Zhang (1999), Braziotis and Tannock (2011), Bobbink, Hartmann, and Dewulf 2016;
Approaches:	e.g. O'Neil and Sackett (1994), Boyson et al. (1999), Browne and Zhang (1999), Dyer (2000), Kinder (2003), Spekman and Davis (2004), Owen et al. (2008), Spekman and Davis (2016)
Particular focus on information and knowledge exchange	e.g. Konsynski (1993), Sehdev et al. (1995), Davis and O'Sullivan (1998), Browne, Hunt, and Zhang (1999), Davis and O'Sullivan (1999), Jagdev and Thoben (2001), Burton and Boeder (2003), Spekman and Davis (2004), Tonchia (2004), Bititci et al. (2005), Coghlan and Coughlan (2006), Braziotis and Tannock (2011), Spekman and Davis (2016)
Sharing technical knowledge and expertise	e.g. Boardman and Clegg (2001), Spekman and Davis (2004)
Change in the power configuration among members	e.g. Bititci et al. (2005), Braziotis and Tannock (2011)

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for instance, Browne and Zhang 1999; Davis and Spekman 2004; Jagdev and Thoben 2001).

In the market, the EE is perceived as a single entity, taking responsibility for the development and the maintenance of products. As such, it is different from traditional SC collaborative forms, where collaboration does not, necessarily, become the focus of the whole SC. In summary, the EE takes SC integration to the next level by incorporating a very long-term and strategic perspective. This process embeds the suppliers via risks and reward agreements into a single SC-wide business model around the focal organisations. Due to the level of integration, and in order to remain competitive in the future, the relationships and outcomes are not only analysed and managed on a B2B level, but rather on the chain level as a whole.

Cagliano et al. (2005, 347) argued that in the case of the EE, 'collaborative improvement' constitutes a type of inter-company collaboration, a 'purposeful inter-company interactive process that focuses on continuous incremental innovation', focusing on developing the EE's collective operational performance. They also argued that in order to successfully implement and sustain continuous improvement (CI) within the EE, a set of sequential actions is required by the participating companies. Optimising the processes along the EE on the basis of information sharing assists in both coping with complexity, as well as adding competitive advantage, namely: enhanced product, process and service development (Mengoni et al. 2011). In summary, the EE incorporates an information and organisation network, extending both beyond each participant's company boundaries. It incorporates both a value-adding operational network and a 'community of practice', with its members learning and developing skills by routinely exchanging knowledge from the development to the delivery phases of products and services (Bititci et al. 2005; Kinder 2003; Mendikoa et al. 2008; Tonchia 2004).

2.2. Strategy and competitive advantage

Porter's (1980) five forces framework has shaped research in many business-related fields with a competitive consideration, and it holds that the importance of each force is related to the industry structure, i.e. the industry's fundamental economic and technical characteristics. An industry can evolve over time, perhaps changing its structure, hence altering the strength of the five competitive forces, resulting in a positive or negative effect on industry's profitability. To achieve sustainable differentiation, Porter (1996) asserted that the essence of strategy is in the activities: deliberately choosing to perform activities in a different way, or selecting different activities from those of rivals. From another important approach, that of the resource-based view (RBV), it is firm heterogeneity, rather than the industry structure, that results in differences in firm performance (Wernerfelt 1984). Hence, firms that possess and control distinctive resources and capabilities can achieve superior market performance (Newbert 2008). Despite the importance in the literature of Porter's five forces framework, more recent research has focused upon the importance of the internal environment, and in particular intangible assets such as knowledge, when attempting to explain performance differences (De Oliveira Wilk and Fensterseifer 2003; Dyer 2000). However, there is some debate in the literature, as to whether the RBV can sufficiently capture how purchasing and SCM can be a source of sustainable competitive advantage (Barney 2012; Hunt and Davis 2008). To integrate network-level strategy, the relational approach has been developed. This perspective suggests that firms may exist as parts of larger networks of relationships with buyers, suppliers and competitors, in which case sustainable competitive advantage can be obtained either through an exchange relationship that cannot be generated by a firm in isolation or through the joint contributions of partners (Dyer and Singh 1998). Consequently, resources critical to a firm can be created through inter-company linkages such as strategic alliances, joint ventures and trust-based relationships (Dyer and Singh 1998), and not only from within one company as the original RBV would suggest (Dyer 2000).

According to Porter (1996), a company can outperform its rivals only by establishing a sustainable difference. He argued that operational effectiveness (OE) and business strategy both play an essential role in superior performance, but work in different ways. OE means 'performing similar activities better than rivals perform them' and it 'includes but is not limited to efficiency' (Porter 1996, 62). OE refers to the set of company practices that facilitate better utilisation of inputs and results in reductions in product defects or faster product development. Although disputed in the literature (e.g. El Shenawy, Baker, and Lemak 2007; Hayes and Upton 1998), Porter (1996) suggested that OE-based competition should produce absolute improvements in terms of OE, but will not necessarily result in relative improvement for a company. It has been argued that differentiation-focused companies perceive supply as

strategic (presumably the planning and design of SCs) to attain their aims, and supply tiers, outsourcing and co-design agreements generate competitive advantage that is achieved through the manipulation of competencies and capabilities (Cousins et al. 2008). As a result, supply is viewed as a core capability in order for a company to be able to offer unique value to the customer (Christopher 2005; Cousins et al. 2008).

2.3. Research gap and research question

SCM has been considered not just as an operations-wise approach, but also an important platform of approaches to delve into business strategy (Cox 1999). Appropriate use of power in the SC relationships fosters relationship commitment, which facilitates CI and reduces transaction costs and opportunistic behaviours (Zhao et al. 2008). The ability to cope with power asymmetry and effectively manage power influences within linked organisations in a SC is the subject of ongoing research and debate (Fawcett et al. 2009; ~~Natour, Kiridena, and Gibson 2011;~~ Soosay, Hyland, and Ferrer 2008; Zhao et al. 2008). However, the ability to manage power asymmetry has not been adequately explored within the EE paradigm. Competitiveness is a fundamental consideration in the EE context since setting up such a collaborative structure aims to create a new form of entity, which will develop, for example, a new competitive product and/or service. An EE needs to link the capabilities of the individual companies and to function with higher levels of effectiveness and efficiency than an individual organisation (Saban 2014). Essentially, collaborative advantage in the EE context extends the focus of competiveness outside the boundaries of single company entities (a truly end-to-end perspective), setting new frontiers for the way business competitive advantage is perceived and generated (Dyer 2000).

However, while the literature has indicated that a change in the power configuration among members is required within the EE to achieve win–win relationships (Bititci et al. 2005), this has not been explored further for its implications. The review of relevant research above has indicated the main themes of recent work, but also intends to suggest that gaps remain, in our understanding of how the emerging EE paradigm operates in practice. To summarise, previous literature has not consistently demonstrated the nature of the interrelationship between competitive business strategy and SC operational capability (Kim 2006). This was the area of our focus, and our research intended to expose the nature of relationships between strategy and operational effectiveness in an aerospace industry EE. We aimed to develop a better understanding of how sharing risks and rewards within the EE may result in effective collaboration among partners, and also affect both strategic decision-making and operational effectiveness issues for partners. In particular, we wanted to establish and evaluate the strategic issues surrounding the organisations' current SC collaboration strategy, operational practices and associated factors (see Figure 1). In this exploratory research, the research question that guided our research can be articulated as: 'How do business strategy, SCM and OE approaches interrelate?' After considering these issues in the case analysis and in the context of established strategic frameworks, the paper draws conclusions about the effectiveness of the EE paradigm, in terms of operational applicability and strategic potential.

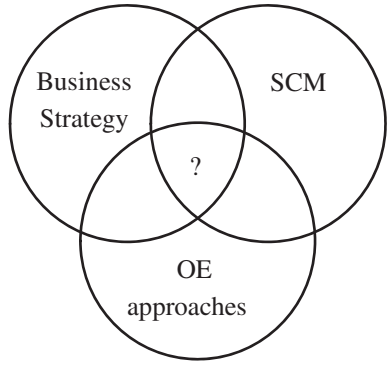

Figure 1. The main focus of the study.

3. Methodology and case companies

3.1. Study design

This research focused on exploring and developing understanding of the interrelationship process between OE approaches, business strategy and SCM in the EE context. Therefore, considering the limited literature available on these domains in the EE context, it was decided to perform an in-depth exploratory study of company cases in the context of a bounded system, i.e. the EE. The aim of this research (Section 2) was to develop understanding about the impact of the SC collaborative conditions within the EE on the industry structure. Due to the nature of the research question, a large-scale survey could be limiting in collecting both the breadth and depth of information required for research of this type in a newly and rapidly developing field (i.e. the collaborative conditions within the EE and their impacts). Furthermore, the descriptive and evaluative aim of this research focused on the insights of the participants about the EE relationships based on their experience. Therefore, it was not considered necessary to utilise and assess numerical data (e.g. past or current performance data), although this may be an area for future work. The reason for selecting a qualitative approach, and in particular the case study research strategy, was the explanatory generalisation function achieved by such a strategy, and the nature of the research question.

The case study approach was employed to perform an in-depth investigation of the behaviour, relationship and approach of the participating companies, considering their operations and relationship in the civil aerospace sector. Case study (see, for instance, Eisenhardt 1991) research is an important form of social science inquiry, especially in the discipline of operations management (Voss, Tsikriktsis, and Frohlich 2002; Yin 2014), and a research strategy which aims at understanding the contemporary dynamics within single settings (Eisenhardt 1989). In operations management, single case studies have been acknowledged for their contribution in theory and practice (Voss, Tsikriktsis, and Frohlich 2002; Westbrook 1994). We aimed to develop understanding about the strategic issues surrounding the organisations' current SC collaboration strategy, operational practices and associated factors, and pave the way for further theory building in that field of research by developing relevant propositions.

Our research focused on both the subunit level (the interrelationships and their consequences among the participant organisations within the EE), and also on the larger unit of analysis (that

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is, the EE, its overall performance and how it operates as a whole in relation to its competitive environment). Hence, as suggested by Johanson and Mattsson (1988), this research addressed the 'microposition' (i.e. the role and importance that a company has for another company), and the 'macroposition' (i.e. the role, importance and strength of relationships that a company has within a given network, as well as the identity of the other companies with which that particular company establishes direct and indirect relationships) to clearly define EE's network boundaries.

3.2. Case companies

Two dyads were selected because they worked together within an EE risk and reward-sharing paradigm, and they were considered appropriate to elaborate on a newly developed paradigm (see, for instance, Craighead and Meredith 2008). The three participant organisations were engaged within the EE: one was the focal OEM, while the other two were first-tier suppliers. This was the unit of analysis, and the identities of the three companies need to remain confidential. Therefore, they are referred to below as OEM X, Company Y and Company Z. The aerospace OEM is an industrial prime with a controlling position in the SC, acting as systems integrator. In the aerospace EE, the first-tier supplier is contractually obliged to manage second-tier suppliers. This is a practice also followed for sub-tiered suppliers in order to ensure conformance within a very highly regulated industry, and in order to optimise the EE as a whole (also refer to Childe 1998). Therefore, it is important to study dyads for the understanding of the EE operations, given that research can capture practices performed by other SC tiers. Our research confirmed that the prime company studied (OEM X) manufactured around 30% of the actual product delivered, with the remaining 70% of components and sub-assemblies arriving through its SCs for final assembly. Companies Y and Z are major suppliers to OEM X, as well as to a number of its competitors, and the authors consider these relationships between them typical of the industry.

3.3. Interviews

Our primary data were collected through semi-structured interviews, supplemented by a focus group. Participants in this research were senior, middle and operational managers in the three organisations. Generally, the principal rule guiding the selection of the interviewees was their relevance to the focus of the research (business strategic decision-making, SCM and OE-related posts). The inclusion of interviewees from different hierarchical levels aimed to increase validation through triangulation, by capturing possible diverse perspectives. The interview protocol that guided our data collection was developed to focus on enhancing discussion with the interviewees that would be relevant to answering the research question. Initial pilot interviews were carried out at OEM X and Company Y to refine the interview protocol.

To facilitate the discussion and retrieve information relevant to the research question, the interview questions in the interview protocol were accordingly grouped into three main sections of questions, namely: *strategy*, *SC integration/development* and *operational effectiveness and the SC*, respectively. The exploratory nature of the research guided the semi-structured interviews according to the specialisation and hierarchical level of the participant. Participants were asked to explain the strategy of their organisation and the relevant competitive pressures. Issues of supplier/buyer power were briefly addressed at this initial stage. Subsequently, participants were asked to explain if their company was an (or part of) EE, and to justify their answer. They were asked to indicate their suppliers and customers, and the strategic concerns in the relationships with them. Approaches and issues in forming partnerships and developing the suppliers were also explored. Issues of communication, information exchange, knowledge exchange and technology used were also addressed. The next set of questions addressed issues, means and prerequisites of the interrelationship between OE and the SC in the EEs they are embedded in, namely: sourcing options and choices, reduction of cost and waste and operations improvement and competitiveness enhancement approaches.

Twenty-nine interviews took place in the three companies, with an average duration of one hour and forty-five minutes, which were audio recorded, assisting in the generation of transcripts for the subsequent analysis. In many instances, follow-up interviews were employed not only to validate some of the initial findings, but also to probe deeper into issues that arose in the first interview. In addition to the interviews, a focus group was organised with 10 operational-level employees from OEM X. During this exercise, an interactive discussion facilitated the capture of valuable information about the company, its relationship with Companies Y and Z and also compared this relationship with other SC relationships. After the initial analysis, a theory building phase ensued, during which key emergent concepts were discussed with senior managers of both companies for validation purposes. The investigation focused upon the relationship of the three case companies, within an EE context. However, the interview discussions also covered and contrasted other SC or EE partnerships, with other companies, which assisted in placing this particular EE relationship in context. This allowed broadening the perspective beyond the dyadic level of relationships. In addition, in many cases, the interviewees from the three companies explained the same processes and events from their separate company perspectives. Further useful triangulation was provided by background company information and by interviews with industry experts.

3.4. Data analysis

The data were analysed using conventional case study methods as proposed by Miles, Huberman, and Saldaña (2014) and Creswell (1998). The information in the interview transcripts was reduced to the level of relevance to our research question, which assisted in the identification of first-order concepts using themes that matched the terminology used in the literature (Jraisat, Gotsi, and Bourlakis 2013; Nemkova, Souchon, and Hughes 2012); this allowed us to effectively group them into second-order themes. We, essentially, performed a 'categorical aggregation', as defined by Stake (1995). Engaging in a 'Reading, Memoing' procedure, we read and reread the interview transcripts and associated notes, making additional notes ('memoing'). This assisted in the generation of themes and categories (Creswell 1998). To generate themes and categories, we initially identified similarities and differences among a representative

number of the interview transcripts in relation to the research question. That assisted in building understanding and creating some initial links among the interviewees' statements, and between those statements and the theory (procedure of 'classification'). We then moved into interpreting our data, i.e. establishing patterns and ensuring correspondence between categories for the data, assisting in linking them to evidence. The case analysis is presented in the following section.

4. Case analysis in the industry context

To facilitate the subsequent discussion, it is of interest to consider the industry's attractiveness using Porter's five forces model. By determining the relative importance of each of the five forces, an organisation can realise the forces which are most important to its competitiveness, and identify where to position itself to take advantage of opportunities and overcome or circumvent threats.

4.1. The threats of potential entrants and substitutes

For aerospace manufacturers, the barriers to entry can be characterised as very high due to the large capital investment requirement, as well as the advanced technological capability and level of know-how required for any potential entrant. It was acknowledged by all participants in OEM X and companies Y and Z that certification legislation in virtually every country closely regulates the design, production and maintenance of civil aircraft, engines and all their components to ensure the safety of the resulting products. Manufacturers must provide the aftermarket support and maintenance required for any product developed and marketed, typically for several decades. As interviewees from OEM X stressed, airlines purchase new aircraft and engines based on many factors, an important one being product standardisation, thus keeping costs as low as possible. Together with company reputation and stature, this creates brand identification and customer loyalty which a new entrant would have to overcome. These are areas that OEM X places particular attention on and constantly manages, as acknowledged by the participants. In contrast, the threat of substitutes for both the airframe and engine manufacturing sectors is low – in the foreseeable future, there will be no alternative product available to the airlines to substitute the conventional fixed-wing airframe design with its gas turbine engines. Although the low threats from new entrants and from substitutes work in favour of the current aerospace manufacturers, the same cannot be said when considering the power of customers and suppliers.

4.2. Leasing services and the downstream supply chain side

In the civil aviation industry, airlines are the primary customers. They decide upon the airframes they will purchase and then seek appropriate engines to power them, the latter representing a substantial portion of the buyer's expenditure. Although these customers often consider issues of product standardisation important (i.e. sharing costs for spare parts and maintenance across product families), they are also prone to 'shop around' and will switch to alternative sellers if the price is considered too high. These considerations extend to the post-purchase phase as well, i.e. the highly profitable aftermarket maintenance, repair and overhaul services. Hence, the power of buyers can be characterised as relatively high, and it is essential for the OEM to engage with customers from the early development phase, listening to and meeting their requirements, in order to win a satisfactory proportion of these markets.

4.3. Risk and revenue sharing partnerships and the upstream supply chain side

Effective use of supplier knowledge and capability is seen as a differentiation factor between product development projects in this particular industry, and it is anticipated that as the result of the shifting of SCM responsibility down the SC, there will be a greater need for supplier integration (MacDonnell and Clegg 2007). Indeed, within this framework, aerospace companies utilise the form of the EE, sharing risks and rewards, to cope effectively with the dynamic market situations. Jordan and Lowe (2004, 241) argued that high Research and Development (R&D) and product development costs enable companies in the aerospace sector 'to share risks and revenue in order to avoid "betting the company" situations in which the failure of a new product can cause the company to fail'. The same authors defined a risk and revenue sharing (RRS) partnership as one 'in which a third party buys a percentage stake in a specific project in return for an agreed proportion of the revenue generated by the project' (Jordan and Lowe 2004, 248).

By establishing RRS partnerships, OEMs share with their suppliers the developmental risk and also the potential market returns once the product is launched. As it was suggested:

> These relationships extend beyond contracts to include business process improvement, price improvement etc. over a very long period. (ISX, Logistics Director for OEM X)

Once agreed upon, the formation of RRS partnerships suggests that the SC becomes more stable in terms of the key integrated members. As a result, SCM within those EEs should be more concerned with increasing the efficiency of the interaction among the key integrated members, effectively managing their established links within the EE formed to provide a contractually based win–win business model for all SC partners. As it was stated:

> You have to look end to end in the EE and see where you can reduce waste and cost (ISX, Logistics Director for OEM X)

4.4. Comparative data analysis

Following Jraisat, Gotsi, and Bourlakis (2013), we structured our data as presented in Table 2. The following sub-sections report on the aspects of the comparative case analysis.

4.4.1. Formation drivers

With the long time frames and the associated high risks and costs involved in developing and marketing a new product, the issue of supplier power is of paramount importance for any manufacturer in the aerospace industry. Porter (1996) argued that companies achieve competitive advantage through acts of innovation. New product development, an act of innovation, is one of the aims upon which aerospace EEs are founded. In this industry, collaborative working is becoming the norm from the

Table 2. Examples of themes: OEM Competitive Benefits from the engagement within the EE.

First-order concepts	Second-order themes	Aggregate dimensions
• The formation of the EE focuses on product and process innovation • Up front RRS payment to support development	Product and process innovation	Operational level: Formation Drivers
• Accumulation for the OEM of vital resources and capabilities drives the EE formation • Inter-firm development capabilities: transfer of capabilities between companies	Operational Capabilities	
• Operational capability enhancement and OE needs also drive the EE formation	Operational Effectiveness	
• Security of supply stream and early involvement of RRS suppliers • RRSP suppliers locked into the EE (bound by contractual obligations) • Limited upstream sourcing options for the suppliers • Everyday customer orders are taken by the OEM • Sales decisions may apply cost reduction pressures on the Suppliers	Upstream power and control: shift to the OEM	Supply Chain level: Formation benefits
• Hybrid leasing approach to secure and protect market (and aftermarket) share, and ensure future income streams	Downstream power and control, extending to aftermarket: shift to the OEM	
• Combined resources and capabilities make the industry more predictable • The EE stabilises the competitive forces • Formidable accumulation of resources increases entry barriers • Engagement of suppliers in the design phase at a contractual form ensures their viability	Predictable Business Industry Structure Influenced	Strategy level: Business Predictability and Industry attractiveness effects

design phase, with inter-company data exchange facilitated by advanced ICT.

The advantage for OEM X from being engaged in RRS partnerships is that it can pass some of the risk to its partners (e.g. development risk, as well as commercial risks). Nevertheless, the interviewees acknowledged difficulties in dealing with cost reduction within RRS partnerships, as well as other problems such as failure to deliver on predetermined dates and management turnover in the company's partners.

For the OEM suppliers, their participation:

> … secures income for the future. HWY (Purchasing Manager for Company Y),

When selecting a supplier for a RRS partnership, the main issue for the management of OEM X to assess is the supplier's competitiveness. Quality is not the first issue; as it was pointed out:

> It is taken for granted in the aerospace industry. (MLX, Operations Director for OEM X)

Therefore, costs and other commercial parameters are initially more important. Due to the price pressures within the industry, there is a desire to make sure that each party involved in the RRS partnership is satisfied, and due to the dynamic global competitive environment, this means that OEM X and an RRS partner may have a joint interest in cost reduction. In practice, the RRS partner is often under pressure to reduce their costs to meet the targets. Essentially, as it was stated:

> He is locked into a share of the revenue. (MLX, Operations Director for OEM X)

The revenue share side for the RRS partner is associated to a fixed percentage of the price for the product. In reflecting upon this approach, it was stated that:

> For a RRS partner there is high risk in their investment, but a high return if the product sells. (ISX, Logistics director for OEM X)

Integration, OE and its development were key issues discussed at the interviews. For instance, OEM X and Company Y had worked closely together on expanding the EE's resources and competences. Co-location of staff was practised by both OEM X and Company Y (and several other EE partners). Staff were also routinely exchanged to facilitate real-time collaboration and effective decision-making. For the RRS partnerships which they had agreed, OEM X and Company Y aligned business processes and exchanged information to assist their collaboration and bring mutual benefit, including information about manufacturing processes, know-how and industry forecasts. As it was suggested:

> Integration makes it easy to handle information, and difficult to switch to other suppliers. (RRZ, Procurement Manager for Company Z)

This information exchange, as well as numerous OE initiatives and practices, was acknowledged on both sides as vital to the EE integration efforts. It was suggested that:

> This is how it works in the industry and every company in the SC is primarily responsible for its SC on 'passing' the tools in order to enhance its supplier's OE. (MKZ, Procurement Manager for Company Z)

Quality, waste and cost reduction are key issues in the industry, and ISX (Logistics Director for OEM X) suggested that the proper way of reducing costs is by focusing on reducing waste. However, this contradicts the view shared in case companies OEM X and Company Y, that the RRS partner, once engaged in the partnership, undertakes the cost reduction task. To further enhance the EE performance, the two companies (OEM X and Company Y) aligned their continuous improvement approaches, sharing knowledge on effective implementation. The two firms' approach to these operational and resource issues took account of their relationships, both with each other, and also with other EE partners. The need to rethink the long-term commitment in RRS partnerships and reconsider pressures on costs was also acknowledged as a potential field for improvement. Interestingly, referring to the suppliers' involvement and investment in the RRS partnership, it was suggested that:

> It may be that our desire for cash weakens our suppliers and they are not as efficient or as able to respond to the changes in the aerospace market. DSX (Business Strategy for OEM X)

4.4.2. Formation benefits

This sub-section will elaborate on the benefits that emerge from the formation of the EE. Considering the upstream power and control dynamics, high-level managers in OEM X acknowledged that once they make the decision to source both design and manufacture of major sub-assemblies from RRS partnerships,

OEMs inevitably surrender some of their control at this level. As it was stated:

> The more integrated you get, the more dependent you are. (RRZ, Procurement Manager for Company Z)

Traditionally, power has resided with the company that had the operational competence and technical capability to produce key components and assemblies. The more important the part or assembly, the higher is this supplier's power. However, issues of power relative to being able to meet cost savings and sourcing options have also determined the power of suppliers. The interviewees acknowledged that within the EE, the OEMs have the power. 'The supplier delivers to the OEMs and …' Company Z '… and this shows in the delivery performance of the suppliers' as MKZ (Global Procurement Manager for Company Z) stated.

The issue of supplier power was addressed in considerable detail during the interviews. Although the EE concept is based on the premise that all partners are treated fairly and transparently, the interviewees indicated that issues of power remain very evident. Moreover, while OEM X and Company Y had clearly worked hard on balancing their partnership and overcoming deficiencies in their relationship, evidence was provided suggesting that OEM X had used its dominant position within the EE to put cost pressures on Company Y, which some within that company found excessive. Past research has reported that, typically, 'the supplier may be more concerned with not being dropped by its existing customers' (Childe 1998, 325) Interestingly, in our research, it was revealed that the two companies were not able to agree on the financial aspects of a potential RRS partner for the design and development of a further new product. As a consequence, although it was generally felt that both companies would have benefited from entering an additional RRS partnership, as they have from previous agreements, price was the key determinant that did not allow such an agreement to move forward.

To complicate matters, manufacturers may collaborate in some market segments (e.g. through supplying one another) and compete in other market segments, a common feature in the industry due to the developmental costs and market risks associated. This creates further issues regarding power in the various SCs, which may confuse company relations. For instance, although that is a major pitfall in their multi-OEM partnerships, it has been accepted by the management of Company Z as part of doing business in the aerospace industry and in dealing with the big OEMs. In addition, it was stated:

> We accept that and we have to live with that. (HWY, Purchasing Manager for Company Y)

The decision for a company to become a RRS partner lies with the willingness of its management to contribute to the project with cash up front, and accept a degree of risk. It is a contractual commercial arrangement by which OEM X depends on the RRS partners, and vice versa. Eventually, as MLX (Operations Director for OEM X) stated, the power lies with OEM X which is the company that accepts customer orders and makes the commercial decisions about the customers. This means that OEM X has to deal with and manage the risk side of the relationship within the market.

> "We trade for upfront money, versus product returns", and "effectively you are borrowing money from your supplier" (DSX, Business Strategy for OEM X)

Nevertheless, every RRS partner has a share in the risk side of the relationship in case unforeseen situations emerge in the development or marketing phases. OEM X shares the profits generated by the product sales at fixed rates and carries the responsibility of coping with the commercial risk factors associated to the product, offering some form of security to its RRS partners. That way, OEM X secures a steady flow of materials, components and sub-assemblies, while its RRS partners secure a proportion of the business (in terms of provision of materials in the production and the aftermarket) for the life of the product.

Reduction in the supplier base is a result of EE formation, and logically suggests some degree of power sacrifice from the OEM, in the sense that both parties in a RRS partnership win or lose together. Yet, as suggested above, OEM power exercised towards RRS partners has often taken the form of cost pressure within existing partnerships. MLX pointed out that it is an interesting debate whether power lies with OEM X within RRS partnerships, and added that:

> Partnership means trust in each other, and the RRS partnership sets the rules of engagement. (MLX, Operations Director for OEM X)

Further upstream in the SC, the issue of supplier power is also, in turn, addressed by the RRS partners. For instance, as HWY (Purchasing Manager for Company Y) stated, the aerospace market they can source from contains few players, facing many regulations and certification requirements. The company has a concentrated supplier base in terms of value, with 20 suppliers covering approximately 80% of the purchasing value. The industry barriers to entry and regulatory requirements mean that prices are high, while the list of accredited suppliers changes little, making it difficult for Company Y to source at lower prices. The only option for Company Y to respond to downstream cost pressures is to put pressure, in turn, on their suppliers to meet specific cost targets. The company's power in this regard depends on the current phase in the cyclical aerospace industry:

> When there is a downturn in the market, the supplier knocks on your door and you can make a good deal in terms of cost. When the market comes back, there is lack of capacity in the industry…lack of raw materials, e.g. titanium. (HWY, Purchasing Manager for Company Y)

He also added that:

> When the market is up, the suppliers want back what they have given before … Lack of capacity means that suppliers can choose their customer.

As a consequence, Company Y constantly struggles to find ways to restrain prices. On the benefits side, the interviewees in Company Y suggested that the integration with both suppliers and the OEMs has assisted the company in terms of performance and competitive position. Their engagement in RRS partnering has resulted in increased profits, accumulation of know-how and has also secured income for the future. In addition, the prerequisite for launching successful quality improvement cross-organisational teams along the EE:

> … is that you have already some kind of an openness and trust between the companies, otherwise you're not going to be successful in the work. LGY (Production Manager for Company Y)

Commenting on the acceptability of these programmes by Company Y and the relationships of the company to its EE suppliers, he added:

> … once the supplier has learnt that we're not doing it to try to squeeze money out of them, we're trying to do it because we have this common objective to reduce cost, improve quality; it's all about reducing total cost. LGY (Production Manager for Company Y)

Considering the downstream power and control dynamics in the aerospace EE, maintenance, repair and overhaul (MRO) of airframes and engines is a major and growing business worldwide. In an effort to increase the profit made, OEM X decided to capture the aftermarket. As it was suggested:

> … this justifies the company's appetite to undertake so much risk. (DSX, Business Strategy for OEM X)

Essentially, the product leasing service that OEM X offers transforms it from a predominately 'product company' to a 'service company'. It was acknowledged by all the interviewees that OEM X was able to achieve this transformation based on the collective capabilities of its collaborations within the EE.

Indeed, aftermarket support now accounts for a significant portion of revenues in the aerospace industry: about 50% in the case of OEM X, while Companies Y and Z also have a substantial aftermarket spare parts and maintenance business. On the downstream side, OEM X offers an innovative differentiated service to its airline customers, in which they do not purchase products from the range offered by the company, but lease the products and pay for their use by flight time. This approach offers customer advantages, as by outsourcing MRO activities, airlines can dispense with costly in-house maintenance facilities. In addition, the product can be more readily monitored and maintained by the OEM, thus ensuring ongoing performance and safety. Here too, innovative EE partnerships are being developed to facilitate aftermarket MRO and logistics for OEM X's products.

MLX (Operations Director for OEM X) stated that the introduction of the leasing service was a competitive move based on the company's collaboration:

> Here is something we can do, we have the skills to do it, then we do it as a new service.

The interviewees acknowledged that within the EE, the OEMs have the power, and as MKZ (Procurement Manager for Company Z) stated:

> The supplier delivers to the OEMs and … and this shows in the delivery performance of the suppliers

4.4.3. Industry effects

This sub-section discusses the evidence on the strategic consideration that derives from the formation of an EE, particularly how such formations influence the industry structure. In the case of OEM X, one of the main advantages of this transformation of the business model towards services on an operations strategy level, as indicated by the interviewed managers, was that the company's management largely shifted its focus from forecasting to planning demand. This offered advantages in terms of inventory and thus costs. Planning demand means that 'speed' is not the key issue anymore, which allows a reduction of structural costs. In addition to restricting the components 'black market', this form of service was considered by the interviewees as a protection mechanism, locking the customer into OEM X. As MLX (Operations Director for OEM X) stated, the leasing service:

> … can offer stability in terms of what you need.

He further argued that it offers advantages in terms of competitive position and strengthens OE aspects through this stability.

Interesting evidence emerged in relation to the influence of the EE on the industry structure. As MLX pointed out, effectively, through the leasing service offered, power shifts from the customer to OEM X: as OEM X undertakes greater commercial risk, the customer becomes more dependent upon it. Hence, in stabilising its customer base, and essentially securing a permanent revenue stream for the future, OEM X realises significant competitive benefits and advantage within the industry. This partial transformation of OEM X into a service company was characterised as a natural evolution for the company considering the competitive forces within the industry; indeed, the interviewees suggested that this appears to be the future for all the aerospace industry OEMs. Nevertheless, the leasing service requires monitoring the performance of the product and it will demand a strong operational focus to make sure the processes are there to support it.

> You can do it more efficiently and cheaper compared to anyone else in the market (DSX, Business Strategy for OEM X)

Through securing future returns on the sales, the previous analysis elaborated on the stabilisation of the supplier power as well. In summary, the OEM eventually occupies a very secure position in the SC by stabilising both supplier and buyer forces in its favour, which influences the profitability, and hence attractiveness of the industry, for competitors within and outside of this industry. As it was stated:

> Power is related to where the money goes. (RRZ, Procurement Manager for Company Z)

5. Propositions and discussion

5.1. Propositions

Although the number of competitors is not increasing, the interviewees in all three companies suggested that competitive rivalry is still intense among OEMs in the aerospace industry. The market is subject to shake-out activities, and the products and services offered feature differentiation aspects (e.g. performance, consumption and emissions, as well as leasing options) in an attempt to capture more customers. Three propositions emerged from the case analysis on the operational, SC and strategic levels, respectively:

(a) *The EE supports innovation in product and process, and enhances operational capabilities and effectiveness*: The EE concept is focussed on product and process innovation. Up front RRS payment by suppliers such as Companies Y and Z to secure a place in the development of a new product offers OEMs the finance required to complete the development phase. For an aerospace OEM, collaboration provides not only development cost reductions, but also the potential to accumulate and secure vital resources and capabilities to design, produce and support new products, meeting competitive targets. OEM X and Companies Y and Z adopted the EE paradigm to grow and exploit inter-firm development capabilities, involving close collaboration between engineering and SCM staff in all three companies to bring the technical capabilities of Companies Y and Z into effective play within the EE.

Although an EE is formed primarily on the basis of development and production of competitive new products, operational capability enhancement and OE needs also drive its formation. Both strategic and operational elements are inherent in the motivation to develop an EE, founded upon the need to increase the performance and competitiveness of the SC. A new product development decision may be strategically driven, but it must also be based on operational capabilities with cost reduction potential. Longer term RRS arrangements tend to fix suppliers into position vis-à-vis their EE partners, perhaps making them preferred suppliers of similar components for later products, and encourage investment and long-term technical specialisation by suppliers to develop and innovate their operational capabilities in specific areas.

(b) *The EE reduces supplier power, but extends control into the aftermarket*: The contractual aspects of engagement in an aerospace industry EE will define the financial conditions of collaboration. The RRS contractual paradigm means not only cash up front, but also a degree of risk adopted by the partnered supplier. Longer term commercial decisions are taken in discussion with the EE partners, but everyday customer orders are taken by the OEM. Sales decisions are inevitably based on market conditions, which may also apply cost reduction pressures within the EE. The two important issues that Company Y faced within the EE were the exercise of power by OEM X towards cost reductions, and its own limited upstream sourcing options. This shifted the power towards OEM X in its relationship with Company Y, challenging the supplier power which might be expected from an analysis of industry attractiveness. We concluded that there is a shift of pressure towards the supplier on meeting cost targets, as they are locked into the EE and bound by contractual obligations in a RRS partnership.

Considering the aftermarket, relatively few airlines nowadays have in-house maintenance operations. Manufacturers and MRO companies can leverage relationships based on collaboration and technology to achieve the necessary technical capability and component traceability to be more efficient and effective in aftermarket support (Farris II et al. 2005). To capture this shift towards aftermarket services, OEM X developed its business model to incorporate a novel hybrid leasing approach, in which it contracts to provide long-term support for its products, which are operated by the customer airlines. MRO and logistics EE partners (some joint ventures with OEM X) were recruited worldwide to assist in providing this service. OEM X is aware that such a service can be imitated, yet they argued that their approach offers marketing advantages, a mechanism to secure and protect market share, and enhances the company's competitive advantage. Other benefits to OEM X are connected with the security of future income streams. Furthermore, this business model offers the opportunity for extending control in the aftermarket business, as it results in power moving from the customer to OEM X. Commercial risks lie to a greater extent with OEM X, but the customers now depend more heavily on OEM X, which can be used to leverage future business.

(c) *The EE makes the business more predictable and influences the industry structure*: Spekman and Davis (2004, 430) suggested that the EE 'is a response to a world where change is unpredictable, costs associated with developing technology, new products, and innovative processes are often too high, and time horizons are too long'. From a strategic point of view, based on the integrated SCM and OE results driven by the integration, the EE, to an extent, 'creates the future' within which it competes, by stabilising for its partners' benefit the competitive forces in the industry. The EE partners' combined resources and capabilities will create conditions to make the industry more predictable, thus allowing them to compete in a more favourable environment. By adopting the EE paradigm and integrating both suppliers and customers in the SC, manufacturers may utilise the maximum economies of scale (supply side) and economies of scope (demand side), thus increasing further the existing barriers to entry. Consequently, through the utilisation of the EE, the threat of new entrants can be further reduced, as a potential entrant would have to cope with the formidable accumulation of capabilities driven by the formation of EEs. That was evident for OEM X, but also for companies Y and Z, which would engage in product developments already from the design stage and at a contractual form.

Moreover, the formation of EEs has an impact on the structure of the relevant industry. Managing the SC relationships changes supplier roles and influences the strategies which guide company behaviour, moving them away from the traditional hierarchical 'tiered' structures towards 'hub and spoke' extended organisations (Cousins et al. 2008). These are long-term arrangements, and the decision to engage in an aerospace RRS partnership usually implies a lasting commitment to support a particular project, which may have a 30–50-year lifetime. Hence, the effect on the industry is likely to be profound and lasting.

5.2. Discussion

The previous section presented the key results that emerged from the research. These can be summarised in the following Figure 2, which illustrates the decision-making sequence and resulting benefits.

The implications of these results will be discussed in two contexts: firstly, the strategic implications within Porter's five forces framework, and secondly from the RBV. To summarise the strategic effects of the results described above, the EE paradigm acts to stabilise competitive forces within the aerospace industry, by reducing the power of suppliers and buyers, 'fixing' the industry structure and further increasing industry barriers to entry. There was strong evidence to suggest that this is the case for OEM X (i.e. influencing the perceived level of profitability, hence attractiveness for the industry sector in which it operates via RRS partnerships and the leasing service offered). The OE practices spreading along the RRS partners in the EE also increase the chances of effective product and process innovation, further increasing the entry

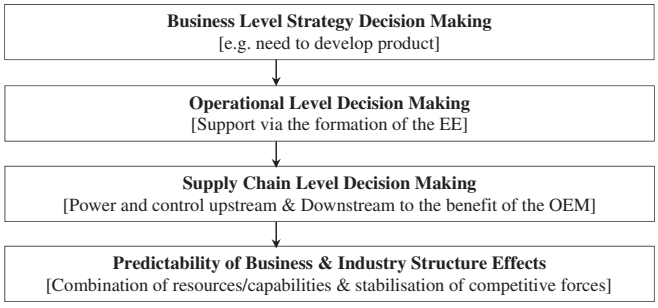

Figure 2. Summary of key results.

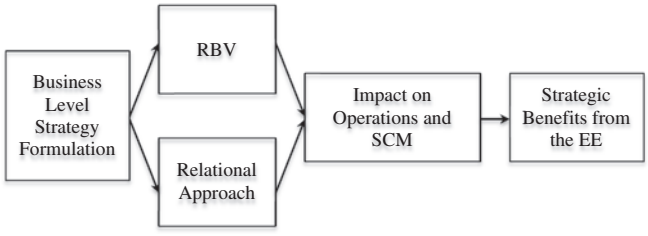

Figure 3. The Conceptual Framework.

barriers to potential competitors. There was also some evidence to suggest that its RRS partners also stabilised the competitive force in their own industry sector.

Each EE seeks also to directly enhance its overall OE and innovation capability, and hence advance its competitiveness vis-à-vis its limited number of direct competitors, most of whom also employ the EE paradigm. The resulting struggle for market share takes place within a highly complex business scenario, in which many suppliers operate within more than one competing EE. Indeed, some of these points suggest that the full strategic benefits deriving from engagement in an aviation industry EE are associated with the 'prime' OEM having secured a dominant position in the EE.

Considering now the RBV perspective, the typical aerospace EE sets the appropriate contractual and operational framework in order to regard its customers and suppliers as 'part of one company', by establishing long-term RRS partnerships. This study showed that in their search for competitive advantage within the EE paradigm, OEMs now engage in operational activities that are embedded in a complex chain of relations with other firms, relying on suppliers to provide highly customised inputs that make up a large fraction of the value of the final product or MRO service. Consequently, the benefits obtained in terms of product and process innovation, quality, cost and delivery, hence the value delivered to the final customer, result from a collaborative effort extending beyond company boundaries.

Several of the key findings presented in this paper have clear implications for the RBV and again indicate a shift beyond the traditional approach, which focuses on the single company entity and suggests that competitive advantage is generated within the firm (Dyer 2000). The findings of this study suggest that the EE encourages specialisation, builds technical capability and enhances innovation in product and process. In these respects, as illustrated in Figure 3, the EE takes the RBV and the relational approach to the next level, and by combining them, it capitalises on a multi-relational approach built around the requirements to develop and support a new product. To the extent that the EE is able to bring to bear the fullest possible resources and capabilities of its member companies, it can enhance its competitive position. However, as illustrated in the previous analysis, it must be remembered that suppliers also have other business priorities. Indeed, some suppliers are members of more than one EE, perhaps having different leading OEMs who may be in competition. Conflicting demands for resources from different EEs may then be brought to bear within these supplier companies, and the outcomes of the resulting resource allocation decisions will influence the quality of the engagement which a supplier has to each EE.

6. Conclusions, limitations and future research

The business environment in the aerospace industry is of great interest. It is characterised by a remarkable mixture of very intense rivalry among the competitors and, at the same time, extreme collaboration with both competitors and suppliers. This seems to be a normal evolution in an industry where a relatively small number of manufacturers is perhaps too many in terms of market capacity: some four main engine manufacturers currently offer their products for respective airliners manufactured by only two main airframe manufacturers. The adoption of the EE seems for these companies a necessary step to safeguard their existence and compete on more advanced forms of SCs.

The theory-building purpose of the study has captured important new aspects of the issues companies face when engaged in an EE, as well as the ways in which the EE as a whole operates and competes. Porter (1985, 7) suggested that 'Firms, through their strategies, can influence the five forces. If a firm can shape structure, it can fundamentally change an industry's attractiveness for better or for worse'. By addressing both operational and strategic issues related to three manufacturers within the European aerospace industry, our study has shown that the formation of the EE can indeed affect the industry structure, hence its attractiveness for OEMs and companies outside the industry. With the use of two dyads as case studies, this paper has attempted to illuminate aspects of the interplay between strategic positioning, SC and OE initiatives. In particular, we have described how strengthening the collaborative form of the SC, by forming an EE with inherent operational and resource goals, has increased industry attractiveness for EE participants, by stabilising the competitive forces. In terms of practice, the outcomes of this research offer the managers of the EE enhanced perspectives in order to effectively realise and achieve the EE's long- and short-term strategic and operational objectives, and estimate and realise both long- and short-term benefits of OE, taking into account the strategic parameters. Thus, this empirical research builds a bridge between notional management practice and actual management practice, as it takes place in the daily business within the EE context. Our paper contributes to our understanding of the way EEs operate and the associated benefits from their formation. This is important considering there is a need for real-life EE cases with real industrial and commercial application (Bititci et al. 2005). It highlights how the combination of the RBV and relational approach does not only enhance product innovation, but also stabilises the industry's competitive forces. Such an approach, facilitated by the formation of the EE, creates an interesting association between business-level strategy

and operations and supply chain strategy decision-making. In other words, it is not the product innovation only that enhances the company's competitive position, but also the establishment of the product value network in the form of an EE (i.e. differentiation in the way companies interact and commit) that results in the establishment of a 'convenient' competitive environment. Continuous focus on OE enhancements for the benefit of the EE as a whole ensures the end-to-end operation improvement and support for the competitiveness of the EE.

The topics with which this research has dealt are of contemporary importance to both the academic and the corporate domains. The EE is a paradigm which is attracting current interest in highly competitive global industries. However, the formation and operation of EEs pose challenges (Childe 1998). This paper has focused entirely on the airspace industry, which has many features that make it unique, compared to less heavily regulated business environments. The case design employed allows for greater depth of research; however, one of the limitations of this study is the application of its findings and proposition in industries with different characteristics and different competitive dynamics. Indeed, it is not certain that the results will be equally applicable to EEs formed in other types of industries outside of aerospace. Another limitation of our research was the focus on two dyads. While during the interviews other SC relationships beyond the dyads were compared and contrasted, perhaps future research could include more dyads. Future research should aim at investigating additional cases to critically compare different applications of the EE form and their strategic positioning and hence to extend the applicability to other industries. Future research could also utilise, in the form of hypotheses, the key findings of this research and quantitatively test the framework using more cases within, or outside the EE aerospace network, i.e. in other industries.

Disclosure statement

AQ4 No potential conflict of interest was reported by the authors.

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