THE COMBINATION OF PRODUCTS AND SERVICES IN BUSINESS NETWORKS: A RESEARCH IN AEROSPACE INDUSTRY

ABSTRACT

This paper contributes to the discussion about the combination of products and services in business-to-business networks. The aim of the paper is to describe how services are provided by manufacturing firms of complex engineering products. The paper presents a case study research about Embraer, a Brazilian company that is the fourth major aircraft manufacturer in the world. First, the paper describes the nature of producer-user interactions of Embraer and its partnerships in the network. Then, the paper presents a framework of interrelated dimensions consisting as Embraer's Business Model, around the combination of products and services in order to attend customer needs. The data were collected through interviews with Embraer`s managers and managers of Azul Airline, a customer firm of Embraer. Secondary material, as technical publications, was also analysed. The research shows an illustration of a web of multiple business-to-business relationships for the provision of products (mainly aircraft) through and with a continuous and "multifaceted" service provision. The case shows some evidences of business model's dimensions for manufacturing firm providing the combination of products and services in aerospace industry. The case contributes to the discussion about extending the role of services in business-to-business networks.

KEYWORDS

Manufacturing firms; Complex engineering products; Product-services combination; Business Models.

COMPETITIVE PAPER

BUSINESS MODELS OF MANUFACTURING FIRMS: EMPIRICAL EVIDENCES OF THE COMBINATION OF PRODUCTS AND SERVICES IN BUSINESS NETWORKS

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ABSTRACT

This paper contributes to the discussion about the combination of products and services in business-to-business networks. The aim of the paper is to describe how services are provided by manufacturing firms of complex engineering products. The paper presents a case study research about Embraer, a Brazilian company that is the fourth major aircraft manufacturer in the world. First, the paper describes the nature of producer-user interactions of Embraer and its partnerships in the network. Then, the paper presents a framework of interrelated dimensions consisting as Embraer's Business Model, around the combination of products and services in order to attend customer needs. The data were collected through interviews with Embraer`s managers and managers of Azul Airline, a customer firm of Embraer. Secondary material, as technical publications, was also analysed. The research shows an illustration of a web of multiple business-to-business relationships for the provision of products (mainly aircraft) through and with a continuous and "multifaceted" service provision. The case shows some evidences of business model's dimensions for manufacturing firm providing the combination of products and services in aerospace industry. The case contributes to the discussion about extending the role of services in business-to-business networks.

KEYWORDS
Manufacturing firms; Complex engineering products; Product-services combination; Business Models.

INTRODUCTION

Market's complexity is forcing traditional product-manufacturing companies to change their position in the goods-services continuum by continuously extending the service business to their offers (Salonen, 2011; Kindstrom, 2010, Reinartz and Ulaga, 2008; Grönroos, 2007; Campbell-Kelly and Garcia-Swartz, 2007; Teboul, 2006; Oliva and Kallenberg, 2003; and Chesbrough and Rosenbloom, 2002). Salonen (2011) emphasized this perspective by highlighting the challenge to move from a goods based logic to a service-centred logic. By this way, some studies have been developed to understand how the concepts of services are

related within the business marketing field (Gebauer, 2008; Cova and Salle, 2008; Sheth and Sharma, 2008 and Van der Valk, 2008). However, according to Spring and Araújo (2009) what counts as a product or as a service is related to the nature of producer-user interactions and the institutional structure of production and networks rather than to the attribute of products or services. Tuli et al (2007) and Kapletia and Probert (2009) also discuss about the concept of solutions as customized and integrated combination of goods and services for meeting a customer's business need. What Oliva and Kallenberg (2003) argue is that moving towards a service-based business model requires not only new capabilities, metrics and incentives needed, but also the emphasis of the business model changes from transactions to relationship-based. In the case of companies that offer services related to complex engineering products, the understanding of the business models that will allow this provision is not yet clear. In this context, some questions arise: How is the combination of products and services by manufacturing firms of complex engineering products in this arena? Which features the business model of a manufacturing firm have for the provision of offers that combine products and services? In order to contribute with this discussion, the aim of this paper is to describe how services are provided by manufacturing firms of complex engineering products. This is a qualitative and exploratory research developed by a case study approach (Yin, 2003). This paper presents a case study about Embraer, one of the major aircraft manufacturers companies of the world. Data were collected through interviews with Embraer`s managers and managers of a customer firm of Embraer, Azul Airline. Secondary materials, as technical publications, were also analysed.

The paper begins by presenting a theoretical review about the concepts of products and services in delivering benefits to customers. We discuss the recent conceptual evolution of services marketing literature, extending to the concept of offerings and solutions. Then, the literature of Business Model is also presented in order to frame action and reveal connexions about how firms can offer the combination of products and services in business-to-business networks. Next, the case of Embraer is described showing empirical evidences of the combination of products and services by manufacturing firms of complex engineering products.

THE PRODUCT-SERVICE DISTINCTION REVISITED

Service used to be conceptualized and defined as being a special type of product. The existence of a continuum is admitted, allowing intangible-tangible extremes as a basis to differentiate pure goods from pure services. The most common perception is that there are packets of products that collect goods and services (Berry and Parasuraman, 1992), distinguishing services by their four characteristics: intangibility, heterogeneity, inseparability and perishability (Fisk et al, 1993). The characterization of the services through these properties predominated in the literature of services marketing, turning to a paradigm to classify the offers in the market. Nevertheless, Lovelock and Gummesson (2004) and Vargo and Lusch (2008, 2004) presented critics to this distinction of the “IHIP”. For these authors, not all services are characterized by these criteria and it is not possible to claim that these characteristics explain all distinctions between goods and services.

According to Grönroos (2006), the evolution of the service-centred logic was influenced by traditional authors from the Nordic School (Grönroos and Gummesson, 1985) and, more recently, by Vargo and Lusch (2008, 2004), who discussed what they called Service-Dominant Logic (S-DL). According to the S-DL, service must be understood as the application of specialized capacities (knowledge and skills) exchanged through business relationships (Vargo and Lusch, 2004, 2008). For Groonros (2006), service can be described

as value-creating support to activities and processes. This way, according to Oliva and Kallenberg (2003) all firms have to do is adopt a unique service orientation. These approaches are similar in conceptualizing service as process for value creation by resources' interactions among the parts in relationships. According to Gebauer (2008), Oliva and Kallenberg (2003), Teboul (2006), and Grönroos (2006), traditional product-manufacturing companies have to change their position in the goods–services continuum by continuously extending the service business in their offers. For this to happen, firms "may decide that providing services is beyond the scope of their competencies (…)" and therefore "not only are new capabilities, metrics and incentives needed, but also the emphasis of the business model changes from transactions to relationship-based" (Oliva and Kallenberg, 2003, p.161). This way, the product becomes part of the offering and the firm must develop services to support and improve continuously its use and effectiveness.

Nevertheless, according to Spring and Araújo (2009) the quest for foundational differences between products and services is misguided. What counts as a product or as a service is related to the nature of producer-user interactions and the institutional structure of production rather than to the attribute of products or services. The product-service founded on the four (IHIP) idiosyncratic features of services as well as process versus outcome consumption doesn't bear much scrutiny. This idea is based on Hill (1977, 1999) and Gadrey (2000) researches' about an institutional perspective on service definition. According to Hill (1977), a necessary condition for some item to be a good or a service is that it must be capable of being the subject of a transaction between two or more different economic units. To identify the characteristics of goods or services, the focus should be on the interaction between producers and users. According to Hill (1977, p.318), services can be understood "as a change in the condition of a unit or a person, or of a good belonging to some economic unit, with the prior agreement of the former person or economic unit". Hill (1999) claims that a service is produced by one economic unit for another, but is not exchanged between them. Products can be disentangled from relationships and capable of independent circulation making them the ideal case for market exchange, but the outputs of services are not separate entities that exist independently of the relationship between producers and users. According to Spring and Araújo (2009, p.4), "in summary, the distinction between products and services often depends more on economic factors that determine boundaries and areas of responsibility in a producer-user interaction than on technical factors concerning production process". This way, Delaunay and Gadrey (1987) and Gadrey (2000) developed Hill`s (1977, 1999) definition by positioning that service activity is an operation intended to bring about a change in the status in a reality C that is owned by consumer B effected by service provider A at the request of B and in a means independently of medium C. However, Spring and Araújo (2009) argue the institutional perspective notion that services cannot circulate as independent entities in a property rights and discuss about what makes services tradable at all. Spring and Araújo (2009) suggest that products and services constitute different types of intermediaries and both require 'stabilization' and 'objectification' (Callon et al, 2002) to be transacted. The objectification of an entity doesn't require that its properties are inscribed into tangibles, solid material even though many services rely on a significant array of tangibles resources. The tradability of a service simply requires that its properties are objectified, stabilised and delimited, i.e., making services tradable requires the regulation of access to maintain socio-technical capacities which may involve a variety of modes of interaction between service providers and users. According to Callon et al (2002), the production, circulation and use of products should not be separated forming a range of services normally associated with those activities. By this way, Araújo and Spring (2006) claims that Ford et al (2003) idea about focusing on mixed offering of product-service combination is a helpful start to overcome the service-product dualism. According to Kapletia and Probert (2009), the concept of solution

can be used to describe an offering. Kapletia and Probert (2009) argue that the predominant view in the literature is that a solution is a customized and integrated combination of goods and services for meeting a customer's business needs. In contrast, Kapletia and Probert (2009) argue that customers view a solution as a set of customer–supplier relational processes comprising: (1) customer requirements definition, (2) customization and integration of goods and/or services and (3) their deployment, and (4) post-deployment customer support, all of which are aimed at meeting customers' business needs. The relational process view can help suppliers deliver more effective solutions at profitable prices. In addition, Kapletia and Probert (2009) research suggests that the effectiveness of a solution depends not only on supplier variables but also on several customer variables. Supplier variables include contingent hierarchy, documentation emphasis, incentive externality, customer interactor stability, and process articulation. Customer variables include adaptiveness to supplier offerings and political and operational counselling that a customer provides to a supplier (Kapletia and Probert, 2009).

The business challenge for most manufacturing firms is how to offer solutions generating a variety of revenue streams from both product and service transactions, as the recent literature on expanding the role of manufacturing suggests (Araújo and Spring, 2006). According to Bryson et al (2004, p.55), "manufacturing still matters, but manufacturing and services have become increasingly complementary and mutually support activities". Howells (2000, p.15) identified two different methods by which manufactured products are not offered to consumers in their own right but, rather, as a part of a package that includes service components: a) manufactured products provided with closely aligned services, and b) the manufactured product supplied to consumers as a vehicle for accessing services, i.e. in cases where the product is not the end point of the transaction, but only the beginning of the relationship between consumer and producer. According to Howells (2000), these types of service/product relationship represent forms of what is termed 'service encapsulation' in which services are wrapped around or embedded in products and in which services can produce innovations in other sectors of the economy. By this way, for Bryson et al (2004), there are four different forms to manufacturing companies transforming themselves into either partial service companies or complete service companies: I) manufacturing-service companies; II) service-manufacturing companies; III) from manufacturing to service companies and IV) virtual production companies. A manufacturing-service company (I) is a firm that has begun to sell services that are linked to physical products. This is the first stage towards becoming a full service company. A service-manufacturing company (II) still produces products but the balance of theirs activities is shifting towards services. Through the process of servicing, product manufacturing companies can learn and develop new products or redesign. On the other hand, companies moving from manufacturing to service companies (III) used to produce or sell goods, but are no longer engaged in these activities. The company begins to sell knowledge-products but rapidly realise that the sale of such products is more profitable than either producing or selling goods. Finally, a virtual production company (IV) is no longer directly engaged in the physical production of products. It has closed or sold its manufacturing plants or may never has been involved in the production process. Products are designed and marketed, but the production process is undertaken by service manufacturing companies, that may not produce a product in their own right, but instead manufacture and even design products for other companies. For Spring and Araújo (2009) the process about moving from manufacturing to service companies highlights the role of the literature on Business Models (Morris et al, 2005; Schweizer, 2005; Magretta, 2002) as a way to understand how firms can fit strategic, operational and economical decisions in order to offer products and services. The ideas of Hill (1977, 1999), Delaunay and Gadrey (1987), Gadrey (2000) and Spring and Araújo (2009) spread out the IHIP idea (Fisk et al,

1993) highlighting that services only can be understood by relationship between actors. In order to reach the aim of this study, the next section describes the concept of business models, in a way to understand how firms can offer the combination of products and services in business-to-business networks.

DIMENSIONS AND THE IDEA OF BUSINESS MODELS

According to Magretta (2002), no consensus exists regarding the definition, nature, structure and development of business models. This concept is also designated by expressions such as structure, architecture, design, plan or method (Magretta, 2002). Nevertheless, Morris et al (2005) analysed 30 definitions of the term and identified three main categories of definition: economic, operational and strategic. The most rudimentary level is defining business models solely in terms of a firm's economic model, focusing on generating profit (Stewart and Zhao, 2000). At an operational level, business models represent an architectural configuration and the focus is on internal processes and infrastructure design which enable firms to create value (Mayo and Brown, 1999). On the other hand, understanding business models on a strategic level emphasizes overall direction in the firm's market positioning, interactions across organizational boundaries, and growth opportunities. According to Morris et al (2005, p. 727), business models can be understood in an integrative way: “a concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture and economics are addressed to create sustainable competitive advantage in defined markets”. According to Morris et al (2005) it is possible to envision a business model's life cycle involving periods of specification, refinement, adaptation, revision and reformulation. The dynamic characteristic of business models was studied by Schweizer (2005). For this author, firms may face the immediate need to change and adapt their business models in order to remain competitive advantages.

For Chesbrough and Rosenbloom (2002) business models can be understood as a way of mediating the value creation process, having the following functions: I) articulate the value proposition, i.e. the value created for users by the offers based on technology; II) identify a market segment, i.e., the users to whom technology is useful, for what purpose, as well as a way to specify the revenue generating mechanism(s) for the firm; III) define the structure of the value chain that the firm requires to create and distribute the offers, and determine the complementary assets needed to support the firm's position in this chain; IV) estimate the cost structures and profit potential of producing the offer, given the value proposition and the value chain structure chosen; V) describe the position of the firm within the value network linking suppliers and customers, including the identification of potential complementers and competitors; and VI) formulate competitive strategies by which the innovating firm will gain and hold advantage over rivals. According to Morris et al (2005), Schweizer (2005), Chesbrough and Rosenbloom (2002) and Magretta (2002) business models can be seen as a way to define and implement a process of value creation. Nevertheless, Ramirez (1999), Lovelock and Gummesson (2004), Grönroos (2006), and Vargo and Lusch (2004, 2008) have claimed the importance of understanding the value creation as a co-production and a co-creation process, for which service has a fundamental role.

The issue of services in business model was described by Mason and Spring (2011, p.1035), for whom a ‘total solution’ market offering is valuable to the customer will depend in part on their ability (or otherwise) to provide the solution for themselves”. In this way, for Mason and Spring (2011) there are three core elements of business models: market offering, technology and network architecture, according to figure 1:

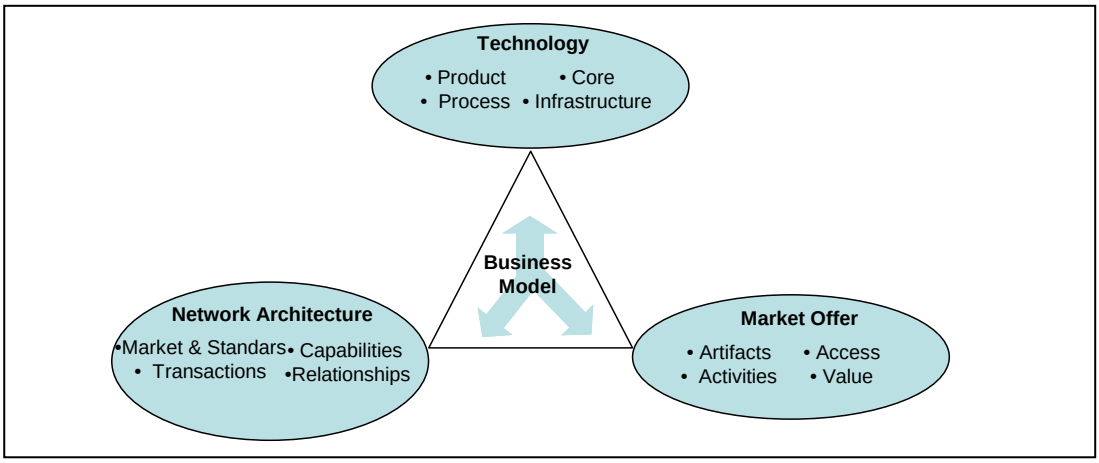

Figure 1: Business model elements
Source: Mason and Spring (2011, p.1034)

For Mason and Spring (2011), the notion of the market offering capture the open-mindedness about the respective roles of products and services in business models. Following Araújo and Spring (2006), Mason and Spring (2011) suggest that the market offering concerns the nature of the producer-user interaction, rather than any essential feature of a particular product or service. An offering consists of the value-creation opportunity arising from alternative combinations of artefacts, access to suppliers' capabilities and capacities, and activities performed by the supplier(s) on the customer and/or its property. The transfer of ownership of artefacts is still central to many business models. Furthermore, the artefact may be implicated in related episodes of activity or access. Activities are perhaps what we typically have in mind when we think about a 'service'. They are concerned with what companies do for a customer as part of the market offering. Access-based business models see the provider retaining ownership of the socio-technical capacities (Gadrey, 2000) that play a part in value-creation. Value can be defined as the benefits derived by a customer from an exchange. Thus in the 'solutions' literature (Windahl & Lakemond, 2006), for a variety of reasons, industrial customers increasingly see value in offerings based on outcomes achieved by suppliers rather than ownership of capital equipment.

Mason and Spring (2011) also suggest that business models are defined by issues of technology. In this way, technology can be understood as the usage and knowledge of tools, techniques, systems, and methods of organisations or material products (Kremer, 1993) and can be divided in three other classes: process, core and infrastructure. Different firms in the network have differing degrees of direct control over these and depending on the specific case, process, core and infrastructural technologies should not be treated simply as 'environmental variables' but as part of the network of internal and external actors that practice the business model (Birkinshaw et al., 2008; Birkinshaw et al, 2007). Process technologies are those used to manufacture products or deliver services. Core technologies are those that underlie particular product technologies. They often dominate managerial practices and have a significant influence on what innovations the organisation identifies, such as specialised chips, small, high resolution screens and small, long-life batteries. Infrastructural technologies are those that enable connexions. In general, these might include the internet, mobile telephone networks and systems for containerised shipping. Such an analysis needs to understand the interplay among these classes of technology (product, process, core and infrastructure) and between them. For Mason and Spring (2011), the dynamic and evolutionary nature of business models becomes clear with the dimension of

Network Architecture, divided in four important categories: capabilities, transactions, markets and standards, and relationships (Mason and Spring, 2011). Capabilities can be understood as the know-how that is retained, maintained and developed by an organisation over time. The ease with which firms can access network counterparts' capabilities is also shaped by the existence and development of markets and standards. Capabilities are also shaped by the existence and development of markets and standards. As markets are made and evolve, standards emerge with them. The standards recognised by firms frame the way managers identify and pursue market opportunities. They are indicative of what might be traded and how, within any business network. Second, the notion of markets and standards might also help managers frame practices for market-making as they seek to influence and shape standards in a strategic move to influence which are adopted (Arthur, 1989). In the other hand, transactions and relationships are important dimensions of Network architecture. If transactions are established between network counterparts, they are often complemented and indeed, enabled, by non-financial exchange and interaction.

Mason and Spring (2011, p.1039) argue that "the value of business models lies in their ability to frame action and reveal connexions between those actions, across multiple levels of analysis". It's necessary to connect micro to the macro level practices: from individual actions of front-line workers to the market level actions of networked organisations. Business models might be understood as bundles of interconnecting practices that evolve with the context within which they are practiced – but that in turn influence and shape the context. Thus, changes in technology practices are likely to lead to changes in network architecture and so on (Geiger and Finch, 2009). In this way, business models are understood to have multiplying sites over time (Schatzki, 2005). The framework is flexible in the sense that, being non-sequential, analysis can begin in any element or elements, depending on current concerns or opportunities. It also seems that there is considerable path dependence in the susceptibility of the various elements to innovation, as well as unanticipated dynamic interconnections between elements. However, Mason and Spring (2011) argue that this is not a sustained empirical study. Future research might also focus on generating insights into the proliferation of business models across business networks as technologies, market offerings and network architectures become shared, overlapping and interlinked. In the case of manufacturing firms that offer services related to complex engineering products, theses dimension need to be clear. Next section confronts theoretical ideas presented in order to describe an idea for a framework of business model dimensions for manufacturing firm providing the combination of products and services.

RESEARCH METHOD

This paper presents a case study (Yin, 2003; Byrne and Ragin, 2009; Ragin, 1992) that contributes to the discussion about the combination of products and services in business-to-business networks. The aim is to describe business models developed around the combination of products and services by a manufacturing focal firm and its partnerships in a business net. This is a qualitative and exploratory research. The selected case (focal firm) is Embraer, a Brazilian company that is the third major aircraft manufacturer in the world. As the business model of a manufacturing firm providing complex engineering products only can be understood by a network perspective (Mason and Spring, 2011), we analysed interfaces between Embraer (as a manufacturing firm) and Azul Airline (as a customer), extending the analysis to interactions involving a supplier of engine.

The data were collected by a desk research and interviews with managers of two companies: 03 managers from Embraer (as the focal firm, which headquarter is located in

São José dos Campos, São Paulo, Brazil) and 02 managers of Azul Airlines (as a customer of Embraer). Data collection occurred through face meetings with managers, in a totally of 16 hours of interviews. Three local visits were also realized for a better understanding of the structure of the firms. Secondary material, as articles and technical publications functioned as a significant source of information, against which the comments and opinions of the interviewees were reflected. The data collected through interviews, in depth, were transcribed and analyzed following the technique of Content Analysis (Krippendorff, 2004). In the next section, we present the case on order to reach the aim of the paper.

PRESENTING THE CASE

> The aircraft is a high performance product that has to meet customer needs comfort, range, speed. The services also have to meet these needs. Sometimes support services come as expanded product. Services typically require dedicated staff, global presence, broad and competitive portfolio (interviewee EMB 02).

Embraer is a company with more than 40 years of experience in designing, manufacturing, selling and supporting aircraft for the global airline, defence and business aviation markets. It produced already around 5,000 aeroplanes, and operates in 88 countries, in five continents, being one of the largest aircraft manufacturers in the world. Based in São José dos Campos, Brazil, Embraer was founded in 1969 as a government initiative and then privatized on December, 1994 (Portazio and Bitencour, 2008). Since then, Embraer develops its activities in order to compete in a global market, offering specific aircraft's three segments: commercial, defence and executive aviation. For each segment, Embraer produces specific airplanes (Embraer, 2012a). Offering services to support those businesses. In order to support its customers and provide after-sales services, Embraer developed a portfolio of Aviation Services, which encompasses aircraft maintenance, spare parts, training and aeronautical systems. Aviation Services unit is divided into different activities: Field Support, Technical Support, Maintenance Engineering, Operational Support, Maintenance Services, Material Support, Technical Publications and Training (Embraer, 2012b).

In order to attend these markets, Embraer has headquarters in São José dos Campos, Brazil, and offices, subsidiaries and customer service facilities distributed around the world. Aircraft and aircraft parts production are made in Brazil units, including sales, logistics and repair management of aircraft parts and technical and operational support. Foreign units, as in USA, Portugal, France, China and Singapore works in warehousing, sales, logistics and repair management of aircraft parts and technical and operational support. Besides the Embraer-owned companies specialized in this type of activity, Embraer Aircraft Maintenance Services (EAMS) and OGMA, located in the USA and Portugal, respectively, Embraer has its own workshops and parts warehouses in the USA, France, China, Singapore and Brazil (Embraer, 2012c)

This paper focuses the Commercial area and the family EMB 170-195. In order to work in designing, manufacturing, selling and supporting aircraft for the global airlines, Embraer develops a series of interactions between its own service units as well as with customers, suppliers and partners. We analysed interfaces between Embraer (as a manufacturing firm), Azul Airline (as a customer) and a supplier of engine. Embraer and Azul Airlines established an interactive interface (Araújo et al, 1999). For the provision of an aircraft to Azul Airline, Embraer also has an interactive interface with a supplier of engine to the aircrafts. Providing more then adaptations, this supplier developed also interactive interface with Azul Airline, in order to develop specifics technologies for the engine. We choose this triad in a way to illustrate the business model of Embraer, as a manufacturing

firm providing services associated with complex engineering products, as illustrated in figure 2:

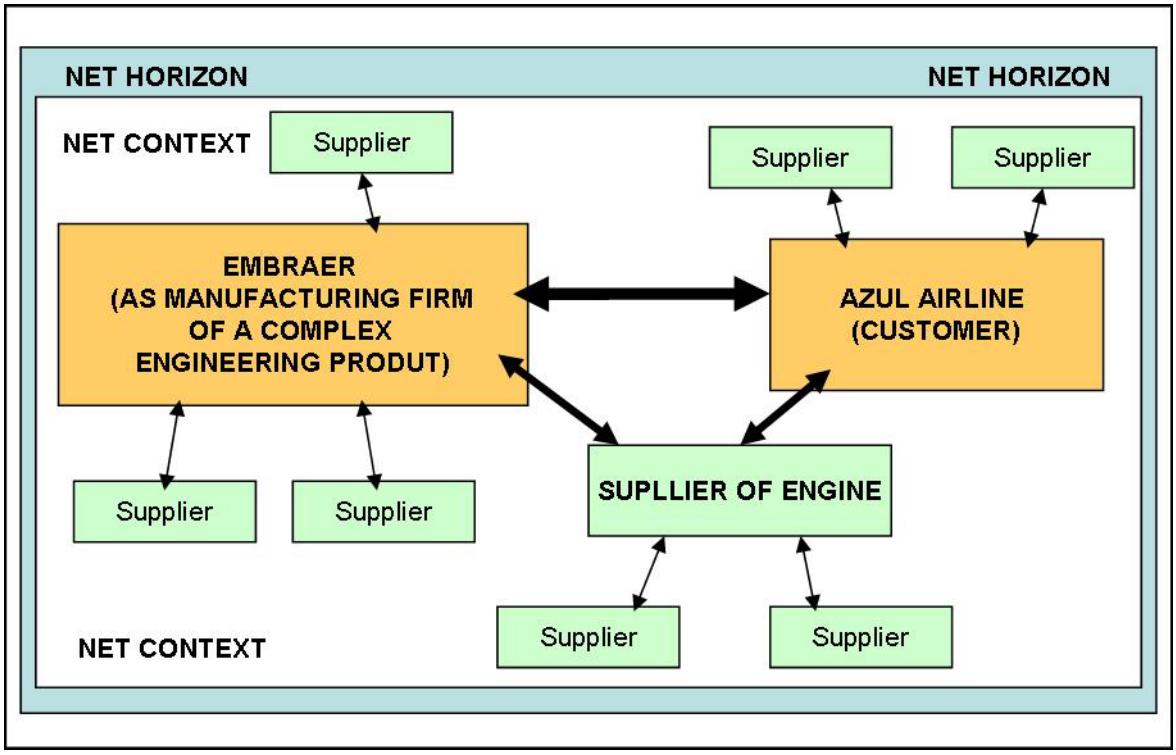

Figure 2: Interactions involving the provision of services associated with complex engineering products
Source: authors

Relationships developed between theses three companies represents interactions, involving adaptations, interchange of resources and capabilities. Thus, at Embraer, there is a network that is "developed", which includes customers and partners, but also suppliers, and the "suppliers of the suppliers" etc. In addition to the network that is built around the supply of products (tangible goods), co-exists a network related to service provision. Both networks are likely to exist in a combined way in order to ensure the provision of value propositions to all actors who are part of the network.

DISCUSSING THE CASE: COMBINATION OF PRODUCTS AND SERVICES BY EMBRAER

To achieve the aim of the investigation, the data collected describes Embraer business model in order to show evidences of product/ service combination in business networks. First, discussions were organized by each essential dimension of business models: market offering, network architecture and technologies (Mason and Spring, 2011) ideas. After, these dimensions are interrelated and dimensions for the Embraer`s Business Model for the provision of products and services are described in order in order to frame action and reveal connexions about how manufacturing firms can offer the combination of products and services as solutions (Kapletia and Probert, 2009).

Embraer`s Market Offering

According to Mason and Spring (2011), the market offering concerns the nature of the producer-user interaction, rather than any essential feature of a particular product or service. According to the interviewee EMB 03, “we offer a product that is a solution. It depends on the niche market”. This idea is also perceived by the customer side, according interviewee of the customer firm, AZUL 02:

> Embraer sells a package. We bought the aircraft and those with a range of services. For example, hiring Program SWAP and OSS saved the cash flow of Azul, especially at the start of operation. The use of these "asset management" programs avoid immobilization of capital in various components of the aircraft and avoid costs in the logistics of repair of parts (interviewee AZUL 02).

Embraer describes itself as a company that works in designing, manufacturing, selling and supporting aircraft for the global airlines. By this way, the combination of products and services at Embraer can be understood according to Bryson et al (2004), for which manufacturing and services have become: I) increasingly complementary and II) mutually support activities. Embraer offers services and products in a complementary way, in order to attend aviation markets. This case is an empirical evidence of Ford et al (2003) idea about focusing on mixed offering of product-service combination as a helpful start to overcome the service-product dualism. On the other hand, Embraer also offers services by support activities (Aviation Services), in order to support its customers and provide after-sales service. This service portfolio encompass aircraft maintenance, spare parts, training and aeronautical systems, which increase the value of use of the Embraer products, i.e. the aircraft.

Thus, the Embraer combination of products and services highlight how service is related with manufacturing firms. Embraer Aviation Services are developed to provide continuous value-added to customers, and are an evidence of Lusch et al (2010) ideas about service as processes for value creation by resources' interactions among parts in relationships. For the other side, Embraer Aviation Services also illustrates the ideas of Hill (1977, 1999), Delaunay and Gadrey (1987), Gadrey (2000) or Spring and Araújo (2009) about the institutional perspective on service definition. Embraer offers services (Aviation Services) intended to bring about a change in the status in a reality C, which is owned by Customer B (as Azul airlines, for instance). Services activities are developed by request of intervention and/or possible collaborations. Acquiring an Embraer aircraft, customer has much different kind of support and after-sales services that can be also developed in collaboration within it, by a dedicated team in order to provide value addition. According to Spring and Araújo (2009), making services tradable requires the regulation of access to maintained socio-technical capacities which may involve a variety of modes of interaction between service providers and users, as we can see in Embraer Aviation Services.

According to the idea about “service encapsulation” (Howells, 2000), Embraer can be seen as a company providing manufactured products with closely aligned services. By this way, according to Bryson et al (2004) concept for four different forms to manufacturing companies transforming themselves into either partial service companies or complete service companies, we can understand Embraer as a service-manufacturing company: Embraer produce products but the balance of their activities is shifting towards services. Through the process of servicing, product manufacturing companies can learn and develop new products or redesign, what can be seen among Embraer, customers and suppliers’ relationships. According to Oliva and Kallenberg (2003), moving from a traditional product-manufacturing

company to extending the service business imply not only in new capabilities, metrics and incentives, but also in the emphasis of the business model changes from transactions to relationship-based, as we can see in Embraer. By this way, Embraer service triangle can be an example about how service provision is directly associated with partnerships, in order to get a business-to-business network for value creation (Lusch el al, 2010). In order to work in designing, manufacturing, selling and supporting aircraft for the global airlines, Embraer is developing a series of interactions among its own service units as well as with customers, suppliers and partners. These dimensions constitute the network architecture of Embraer`s business model.

Embraer Network's Architecture

According to the interviewee EMB 01, "the development of an aircraft is customer-oriented". When the client needs to some adaptation, the exchange of skills and competences (as process of services) are needed. The exchange of skills, competences and know-how between Embraer and suppliers is what enables the delivery of the aircraft with the necessary adjustments. In this way, both managers of Embraer, as those of Azul, underscored the importance of continuous interaction between all parties involved:

> We have regular meetings with key suppliers and customers. This occurs at regional or global levels, depending on the location of customers. We always seek to develop win-win relationships with our customers. (interviewee EMB 03)

> Reliability data is made available to customers in order to help them meet the requirements of their Reliability Programs. There are monthly reliability meetings that take place with people of all parties (Azul, Embraer and key suppliers). These meeting are important to develop the product and improve system performance. (interviewee AZUL 02)

By this way, the provision of services by Embraer can be understood through a network perspective. According to IMP Interactive and Network approaches, the term network refers to the exchange connection between multiple firms that are interacting with each other (Easton, 1992; Axelsson and Easton, 1992; Easton and Araújo, 1992; Ford, 1997). Thus, for the service provision, there is a network that is "developed", which includes clients and partners (as service centers), but also suppliers, and the "suppliers of the suppliers" etc. In addition to the network that is built around the supply of products (tangible goods), co-exists a network related to service provision. Both networks are likely to exist in a combined way in order to ensure the provision of value propositions to all actors who are part of the network. According to EMB02, the aviation industry usually categorizes as "Supporting" those services that already come with the purchase of the aircraft, and exactly as "Services", those that are sold separately. Acquiring an Embraer aircraft, customer has much different kind of services that can be also developed in collaboration within it, by a dedicated team in order to provide value addition. However, when the aircraft is already in operation, customers can access services by different ways: Embraer aviation services, in-house services or independent services providers. Each type of contract between the supplier of the aircraft and the airline can establish or not to offer services. Generally, supporting services are already offered in conjunction with the aircraft. But other specific services can be negotiated separately. Competitive advantages of Embraer come from the ability of the company offering support services, but also dealing with differentiated services. According to Spring and Araújo (2009), making services tradable requires the regulation of access to maintained

socio-technical capacities which may involve a variety of modes of interaction between service providers and users, as we can see in Embraer Aviation Services.

Technology

> The subordination of the final decision about technology is to the customer. We are always searching an innovative product, a competitive technology that brings value. We develop firstly what customers want, not what our engineering team wants. This is one of our sources of advantage (interviewee EMB 01).

The dimension of technology, according to one of the interviewees at Embraer (EMB 01), is crucial in understanding the combinations of products and services as value propositions. Figure 3 below summarizes how the dimensions of technologies, time and the delivery of products/services interact in the commercial aerospace industry:

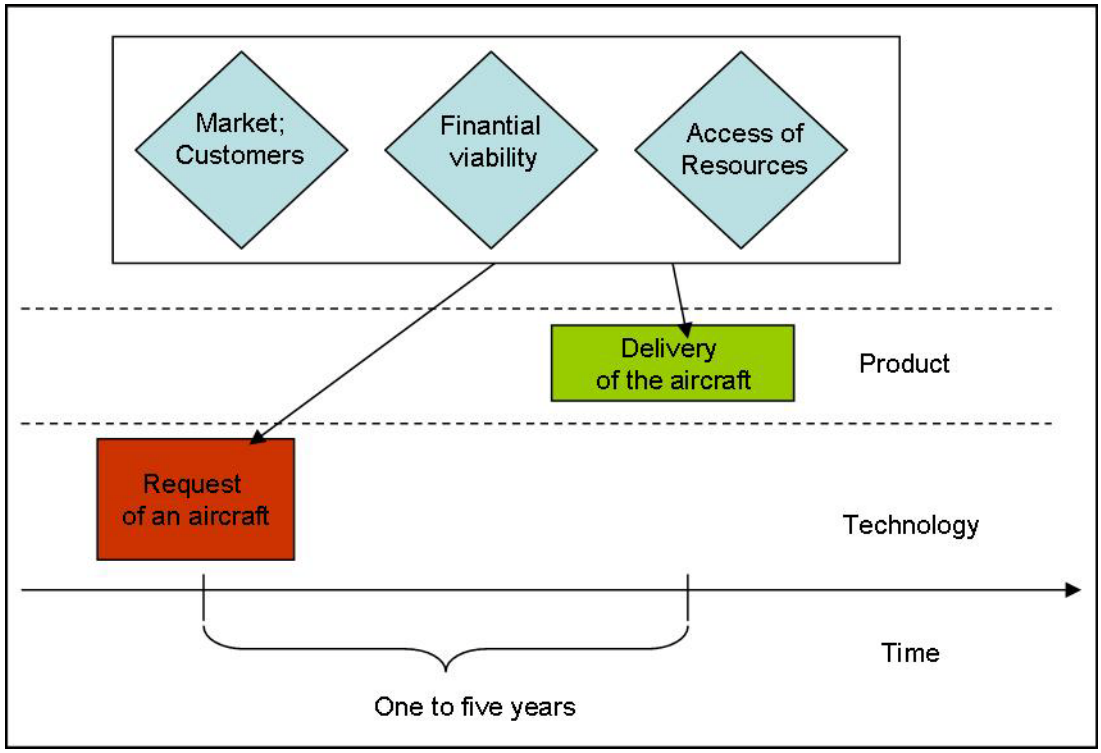

Figure 10: Time, technologies and products interaction in aviation area
Source: design by interviewee EMB 01

The development of an aircraft may take one to five years. In the relationship start-up phase, an analysis of available technologies and competition with the customer allowed decisions to be made as to what should be developed internally (Embraer), shared and develop with (key supplier of engine, for instance), or sourced from the market (commodities). Integrated and proactive approaches between actors led to frequent updates of the value proposition over time before the delivery of the final aircraft. The useful life of an aircraft is approximately 20 years. This means that it is not just a question of integrated and proactive approaches leading to aircraft sales. Embraer offers continuous technology upgrades to Azul Airline. “Over the lifetime of the aircraft, our interfacing with customers is broad and continuous. An aircraft is a product that is alive!”, as confirmed by interviewee EMB 03. “To be able to meet up with Azul’s evolving needs has meant frequent exchanges

not just between us and Azul but joint meetings and exchanges with the supplier of the engine, for instance". Embraer to be competitive thus needs to find suppliers as partners, willing and capable of doing this. "For some projects, we have here a supplier team working together with us. This is done when we need to developed something in conjunction" (EMB 01). Process technologies are those used to manufacture products or deliver services. In the case of Embraer, activities developed by Aviation Services can be seen as process of technologies delivering services. The system named as FlyEmbraer can be also seen as an infrastructure technology, allowing a permanent interaction between Embraer and customers. All these technologies characterizes Embraer`s business model and are important paths for value creation, for which services are developed.

Thus, Embraer`s product and service combinations provides from the nature of the producer-user interaction. The business model of Embraer providing solutions can be understood by interlinking the three essential dimensions of business models: market offering, network architecture and technologies (Mason and Spring, 2011). The analyze of data can show that Embraer`s business model providing the combination of products and services can present the characteristics described in Figure 7: customer orientation; relationship based; access-based; market offering provider (porfolio of goods and services); development of technologies for differentiation and adaptability (temporal evolution). The influence of network dimensions is considerate in and evolutionary perspective. Thus, products and services are offered by Embraer in order to obtain a competitive advantages over time.

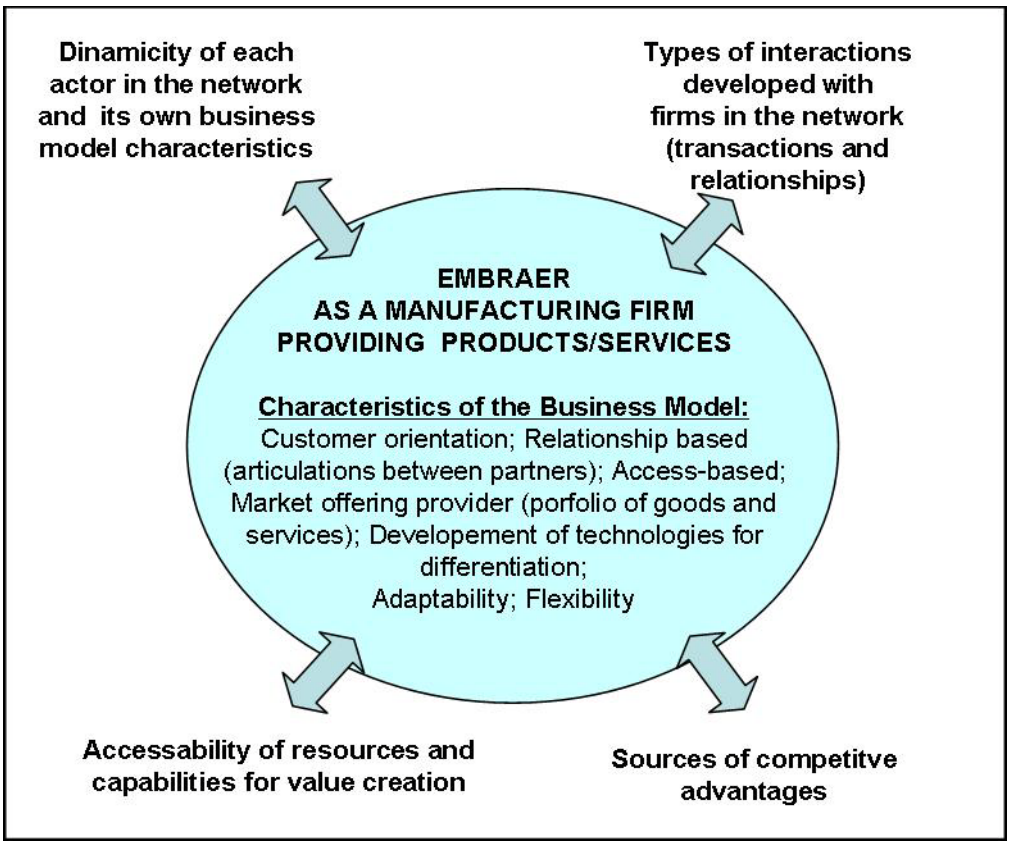

Figure 3: Dimensions of Embraer`s Business Model for the provision of products and services as combined offerings
Source: authors

FINAL CONSIDERATIONS

The case of Embraer can be seen as an empirical evidence of a manufacturing firm business model involving product-service combination. This paper shows that as a manufacturer, Embraer offers service activities to develop and to support its products. Thus, developing service activities, Embraer turned itself into a service-manufacturing firm, which works to and/or within its customer and suppliers allowing the creation of value. Embraer is a case study that contributes to the discussion about how a manufacturing firm can generate a variety of revenue streams from both product and service transactions. The analysis done showed how designing, manufacturing, selling and supporting aircraft for the global airline business results in web of interactions for the provision of a combination of products and services (as solutions). The case of Embraer can show some evidences about manufacturing firms business model for the provision of solutions, as described in Figure 3.

This is a case study research that is limited for conclusions. But, this study can be a useful example for manufacturing managers trying to extend service business to their offers. Further exploratory and descriptive research can be done. The challenge to managers in manufacturing firms is to try to focus on mixed offering of product-service combination (Ford et al,2003), understanding their business models as a framework of interrelated dimensions including all product/services relationships. From this paper, some questions arise for further investigation. Embraer is a case of a service-manufacturing company that offers services to reach its aims besides manufacturing. However, business models of manufacturing companies need to be understood for different product-service combinations that are related to the nature of producer-user interactions and the institutional structure of production and networks (Spring and Araújo, 2009). Does each one of the four different forms (Bryson et al, 2004) to manufacturing companies transforming themselves into either partial service companies or complete service companies involve different business model's dimensions? Moving from a manufacturing firm into a service provider is still a challenge for managers, but is a way to obtain competitiveness.

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