

# MANAGING THE TRADABILITY OF SERVICES: COMPLEX ENGINEERING PRODUCTS, SERVICES AND BUSINESS CONTRACTS IN INDUSTRIAL NETWORKS

**Fabiana Nogueira Holanda Ferreira (Corresponding author)**

PhD Student

Faculty of Economics – University of Porto  
Rua Dr. Roberto Frias, 4200-464 Porto PORTUGAL  
+351 225 571 100

[fabiana@fep.up.pt](mailto:fabiana@fep.up.pt)

[fabianaporemil@yahoo.com.br](mailto:fabianaporemil@yahoo.com.br)

Present address: Rua José Vilar, nº1582, apto 1101

Fortaleza, BRAZIL

+ 55 85 99879273

ZIPCODE: 60.125-000

**João F. Proença**

Advance-Centro de Investigação em Gestão, ISEG - UTL

Associate Professor

Faculty of Economics – University of Porto

[jproenca@fep.up.pt](mailto:jproenca@fep.up.pt)

**Robert Spencer**

Associate Professor

Euromed Management Marseille

Domaine de Luminy

BP 921 – 13288 Marseille cedex France

+33491827348

[robert.spencer@euromed-management.com](mailto:robert.spencer@euromed-management.com)

**Bernard Cova**

Professor

Euromed Management Marseille

Domaine de Luminy

BP 921 – 13288 Marseille cedex France

+33491827348

[bernard.cova@euromed-management.com](mailto:bernard.cova@euromed-management.com)

# **MANAGING THE TRADABILITY OF SERVICES: COMPLEX ENGINEERING PRODUCTS, SERVICES AND BUSINESS CONTRACTS IN INDUSTRIAL NETWORKS**

*Purpose of the paper and relevant literature* - The aim of this research is to provide a better understanding of how manufacturing firms of complex engineering products manage the offer of services in their business contracts. For Spring and Araújo (2009) products and services are related to the nature of producer-user interactions and the institutional structure of production and networks. The tradability of a service requires that its properties be 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 (Callon et al, 2002). In this context, some key questions arise: how do manufacturing firms of complex engineering products manage the tradability of services involving a variety of modes of interaction between service providers and users? How do they offer services in their business contracts with customers?

*Research method* - In order to support these questions, qualitative and exploratory research method is adopted, developed via a multiple case study approach (Yin, 2003) in the aerospace industry. The data were collected through interviews with managers of six firms that are involved as manufacturing firm, customer and supplier in an industrial business network. Secondary material, such as technical documentation, was also analyzed.

*Research findings* – First, the data describe how firms in the aerospace industry establish their business contracts involving customers and suppliers relative to the provision of services. Despite the fact that the value proposition of the manufacturing firm can be understood as a combination of products and services, the data show that manufacturing firms in the aerospace industry draw a distinction between services related to support and maintenance and other types of services offered to their customers. To manage service tradability, services understood as support and maintenance activities are offered, essentially, from the initial contract onwards, as a fundamental condition of the product/service combination. Other types of services however can be sold separately, and these other services are useful for purposes of differentiation.

*Contribution* – The paper contributes to the discussion about how manufacturing firms of complex engineering products can offer a combination of products and services (as mixed offerings) in their business contracts. Considering the nature of producer-user interactions and the institutional structure of production and networks, the paper describes ways in which firms can manage the tradability of services over time, offering continuous value propositions.

**Key-words: Business Contracts; Complex Engineering Service Systems; Industrial Networks; Tradability of Services.**

**Track: Managing Industrial Networks**

**Type of paper: Competitive Paper**

## INTRODUCTION

This paper contributes to the discussion about the role of service in complex engineering systems. Since Lovelock and Gummesson (2004) contested the validity and continued usefulness of IHIP (intangibility, heterogeneity, inseparability and perishability) as a core paradigm to differentiate services from goods (Fisk et al, 1993), several studies have attempted to understand the impact of this conceptual shift. Authors, such as 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), claimed that market 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. Gebauer (2008) emphasized this perspective by highlighting the challenge to move from a goods based logic to a service-centred logic and some studies have been developed to understand how the concepts of services are related within the business marketing field (Gebauer, 2008; Cova and Salle, 2008b; Sheth and Sharma, 2008 and Van der Valk, 2008).

According to Ng et al (2011), for manufacturers of complex engineering equipment, the focus on service and achieving outcomes for customers is the key to growth. Yet the capability to provide service for complex engineered products is less understood. In this context, some questions arise: how do manufacturing firms of complex engineering products manage the tradability of services involving a variety of modes of interaction between service providers and users? How do they offer services in their business contracts with customers? The aim of this research is to describe how manufacturing firms of complex engineering products manage the offer of services in their business contracts. This is a qualitative and exploratory research developed using a multiple case study approach (Byrne and Ragin, 2009; Ragin, 1992; Yin, 2003) as method to investigate contemporary phenomenon within its real life context and in which multiple sources of evidence are used. The study was developed using the aerospace industry as an example of a complex engineering service system. One of the leading aircraft manufacturers worldwide and its partners are the unit of analysis. The data were collected through interviews with managers of six firms involved as manufacturing firm, customer and supplier in an industrial business network. Secondary material, such as technical publications, was also analysed.

The paper begins by presenting a theoretical review about the concepts of products and service in delivering benefits to customers. We discuss the recent conceptual evolution of the services marketing literature, extending to the concept of offerings and solutions. Then, the paper presents the literature about relationships in business to business networks and business contracts. Next, the case of EBR is described showing empirical evidence on the tradability of services in complex engineering service systems.

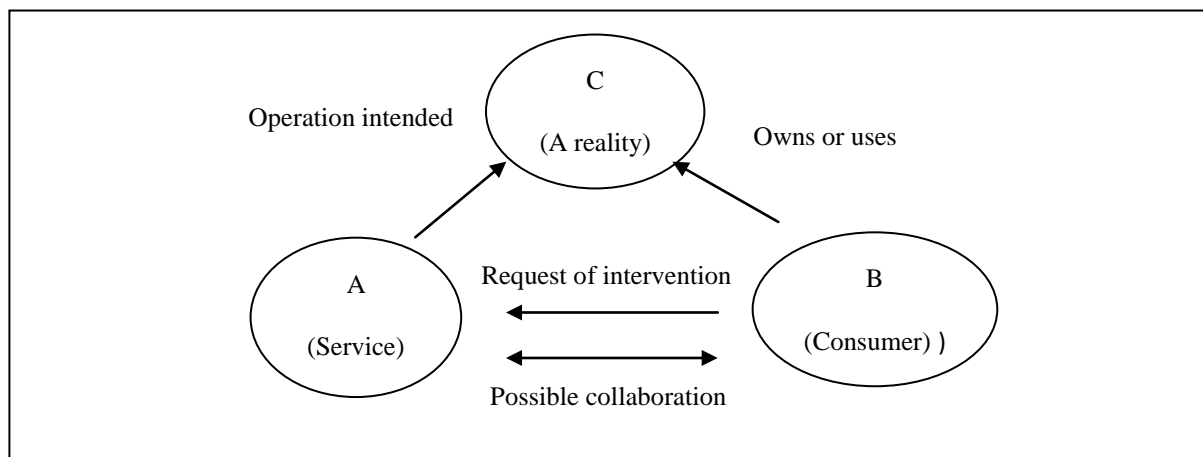
### **THE TRADABILITY of SERVICES: PRODUCT-SERVICE DISTINCTION REVISITED**

Service used to be conceptualized and defined as being a special type of product. 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 (2004, 2008), 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 Grooten (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 continuously improve its use and effectiveness.

Nevertheless, according to Araújo and Spring (2006) 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 (Fisk et al, 1993) as well as process versus outcome consumption does not bear much scrutiny. This comment is based on the research by Hill (1977, 1999) and Gadrey (2000) on an institutional perspective for 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. In the words of 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”. Thus Delaunay and Gadrey (1987) and Gadrey (2000) developed Hill's definition (1977, 1999) by positing 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. This idea is illustrated by Spring and Araújo (2009, p.449), in Figure 1:



**Figure 1: The service triangle**  
**Source: Spring and Araújo (2009, p.449)**

However, Spring and Araújo (2009) argue the institutional perspective notion that services cannot circulate as independent entities in a property rights, and discuss 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 does not require that its properties be 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 be 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. In this way, Araújo and Spring (2006) claim that the Ford et al (2003) suggestion about focusing on mixed offering of product-service combination is a helpful start to overcoming the service-product dualism. The business challenge for most firms is how to generate a variety of revenue streams from both product and service transactions, as the recent literature on expanding the role of manufacturing (Araújo and Spring, 2006) suggests. According to Kapletia and Probert (2010), the concept of solution can be used to describe complex product-service offerings such as aerospace and defence systems. Solutions refer essentially (Nordin and Kowalkowski, 2010) to an offering that incorporates a number of integrated services into the customer’s value chain and that forms a non-dissociable whole. In addition, Tuli et al (2007) research suggests that the effectiveness of a solution or a “solutioning system” 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 Tuli et al (2007). As a consequence, we acknowledge the idea that “solutions are co-created by a customer and a supplier and cover all aspects of the relationship (commercial, operational and financial); solutions are customized in one or more of the following aspects: design, assembly, delivery, operation or pricing; solutions involve the supplier taking managed risks and therefore often include performance and/or risk based contracts” (Cornet et al., 2000, p. 2).

Solutions represent the type of value proposition which best marries the evolution towards improved integration into the value chain and increased coordination among the elements which go to make up the offering. The first point is related to the content of offerings and more particularly the service dimension of offerings. This point stresses the degree of integration of the offering within the customer's value chain. Customers expect a solution to include processes directed at understanding their requirements, customizing and integrating products, deploying them, and supporting them on an ongoing basis (Oliva and Kallenberg, 2003; Tuli et al, 2007). The latter point deals with the combination of the elements which make up these offerings. This point concerns more specifically the degree of coordination of these elements with each other, giving rise to a unique and non-dissociable whole (Davies et al, 2006). These discussions highlight the issue of business contracts in industrial networks. How can firms manage the provision of products and services (as solutions) in complex engineering service systems?

The following section discuss about the traditional product-manufacturing companies to change their position in the goods-services continuum by continuously extending the service business to their offers, and the role of business contracts in this context.

## **COMPLEX ENGINEERING SERVICE SYSTEMS AND BUSINESS CONTRACTS**

The evolution on the goods-services continuum is particularly true for complex engineering products that require complex engineering capabilities to support their design, construction, operation and maintenance, i.e. complex engineering service systems which provide integrated systems (solutions) for the customer (Davies et al, 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. In 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 realises 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 have 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.

The ideas of Hill (1977, 1999), Delaunay and Gadrey (1987), Gadrey (2000) and Spring and Araújo (2009) go beyond the IHIP approach (Fisk et al, 1993) highlighting that services only can be understood by relationships between actors. The issue of business contracts emerges as a way to reduce or minimise uncertainty and risks between the parties in business relationships (Williamson, 1975, Roxenhall and Ghauri 2004). The reason for using a business contract is usually one of the following: (i) to function as a communication tool for the transmission of information from one party to another; (ii) to reduce uncertainty and risk by stating each party's contribution to the relationship; and/or (iii) to fulfil the requirements of accepted practice in a given business setting (Roxenhall and Ghauri, 2004; Roxenhall, 1999). For authors such as Roxenhall and Ghauri (2004) and Narula and Hagedoorn (1999) the role played by the contract in a business relationship varies depending on the particular business context. According to Macaulay (1963), a contract specifies the duties and obligations between two or more parties concerning the exchange of goods or services and is also enforceable by law. Most business relationships include different forms of formal contracts.

In many cases a contract is seldom (or never) consulted once it has been drawn up. The contract exists mostly to give an overall governance structure to the evolving business relationship between the interacting parties. As a consequence of the different roles and functions of contracts, there are a variety of contractual arrangements. A contrast can be made between complete contracts (which specify all conceivable scenarios) and incomplete contracts (in which it is recognized that not all factors capable of affecting a contract are foreseeable at the time of finalizing it) (Hart and Holmström, 1987). The latter allows scope for interpretation, discussion, and maybe disagreement, although such a contract might be less secure. Complete and incomplete contracts (Hart and Holmström, 1987) can be compared to what Macneil (1978) classifies as transactional and relational contracts. Transactional contracts are more like formal legal contracts which are characterised by formal rules, quantifiable contents, and a defined period of validity for the contractual arrangement. Transactional contracts could be compared to the complete contract mentioned above (Hart and Holmström, 1987; Williamson, 1975). Typically, transactional contracts are of short duration and focus little on "personal" activities; rather, they tend to focus on issues that can easily be measured, preferably in monetary terms (Macneil, 1978). Relational contracts are more difficult to describe and specify; although they do have a specific period of validity, the exchange variables specified in them can be measurable and/or immeasurable (Macneil, 1978). In these types of contracts, there is less focus on legalities and more on reaching mutual understanding as regards the meaning of the relationship and the benefits to be gained from the contractual agreement in question. Macneil (1978) has used the term 'relational contract' to describe this situation, in which the real focus is less on legalities and more on reaching mutual understanding about the true meaning of the relationship and what the parties will gain from the arrangement. In these situations, a formal written contract is usually complemented with other mechanisms (often certain aspects of so-called 'relationship management') to manage the day-to-day interaction between the parties (Brown et al., 2006; Seshadri and Mishra, 2004). In other business contexts the contract plays a more explicit role in governing the relationship between the parties. In such 'relational contracts', the structure and

processes of relationships take precedence over attempts to foresee and resolve all the problems that might arise in the contractual setting (Macneil, 1978). Another type of more flexible relationally-focused contract is the type that Mouzas and Ford have discussed in various articles, labelled 'umbrella agreements' or 'framework contracts' (Mouzas and Ford, 2006, 2007; Mouzas, 2006). An "...umbrella agreement is a joint consent which explicitly sets out a framework of principles with the aim of providing flexible guidance for future contractual decisions" (Mouzas and Ford, 2006:1249).

According to Davies et al (2007), complex engineering products require complex engineering capabilities to support their design, construction, operation and maintenance, i.e. complex engineering service systems which provide integrated systems (solutions) for the customer. For this provision, the manufacturing firm has to decide between "buying" or "making", for the provision of a complex combination of goods and services as solutions. Manufacturing firm must compare the benefits and costs of using the market as opposed to performing the activity internally. On the "buying" extreme, there are isolated market transactions (spot markets). At the other end, related to the decision to "make", there is what is called vertical integration, i.e. the internalization of production through the acquisition of a supplier of inputs. At an intermediate point of this continuum, relations are performed for long-term contracts, such as occurs in cases of outsourcing. In addition, they must choose which ensures greater efficiency. The current importance of economies of scale in competitive markets, the emergence of new information and communication technologies which make the relationship between enterprises and suppliers globally accessible, have facilitated the development of outsourcing relationships. Thus, for a better understand about complex engineering products, services and business contracts in industrial networks, relationships developed by the manufacturing firms with a diversity of suppliers in order to attend Customer's needs have to be considerate. The access of resources and capabilities of third parties requires definitions. Accessing products and services from external suppliers, organizations are seeking effectiveness and efficiency for the production process. This is related to the enforcement of strong, legitimate partnerships, without abdication of responsibilities and prioritizing the balance of forces between the contractor and the hired. This research focuses in on this context, in an attempt to provide improved understanding about how firms manage the tradability of goods and services in complex engineering systems.

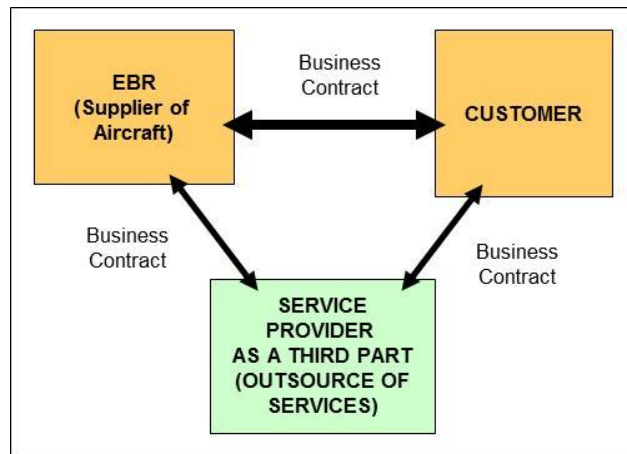
The following section presents the methodology used for the purposes of the investigation.

## **RESEARCH METHOD**

Case study research (Byrne and Ragin, 2009; Ragin, 1992; Yin, 2003) investigates contemporary phenomenon within its real life context and in which multiple sources of evidence are used. Dubois and Araújo (2007) examined the application of qualitative research and discussed single and multiple case designs. This is an exploratory and qualitative investigation. The aim of this research is to describe how manufacturing firms of complex engineering products manage the offer of services in their business contracts. In a similar vein to recent research on complex engineering service systems (Ng et al., 2012), we choose to investigate here the aerospace industry in which manufacturing companies of aircraft, helicopters, engines and other major equipment suppliers are increasingly becoming solution providers by integrating elements of product and support services. The complexity of relationships between firms in

complex engineering service systems adds an extra challenge to improved understanding: i.e. the role of the customer coupled with that of one of the partners in the same partner network space (Helander and Möller, 2007; Cova and Salle, 2008a, 2008b) has to be investigated. One way of handling this complexity is to consider triads. Complex engineering service systems can be better understood by a triadic perspective (Vedel et al., 2012) and especially in the aerospace and defence markets (Peng et al., 2010). It is a triad that captures the basic essence of a network (Choi and Wu, 2009) and allows us to study the behavior of a network to understand the complexity of such business realities. To reach the aim of this research, we choose to understand how business contracts are developed in complex engineering service systems considering triads of service in aerospace industry. Typically, a triad of actors is involved in any outsourcing situation: the buyer, the supplier and the buyer's customer. In manufacturing, the buyer acts as a bridge between its supplier and its customer and maintains this bridge position before, during and after the outsourcing (Choi and Wu, 2009). In each triad, we focused the relationship between a Manufacturing firm, a Customer and a Service Provider, as a third part developing mutual relationship. We considered a Service Provider (not a supplier of manufactured goods) to allow a better illustration for the complexity of service provision in business networks. Business contracts established among these firms were analyzed in order to answer the two key research questions: how do manufacturing firms of complex engineering products manage the tradability of services involving a variety of modes of interaction between service providers and users? How do they offer services in their business contracts with customers?

Relationships developed for the provision of aircraft are complex and can be a useful example for the understanding about the tradability of services in complex engineering service systems. The survey was developed from the identification of triads in the business network of EBR, one of the major aircraft manufacturing company in the world. This company (as a focal firm) was regarded as a common point for each triad, allowing the identification of its relationships with service providers and customers, according to figure 2:



**Figure 2: Example of one triadic relationship**  
**Source: authors**

Considering this, four triads were identified, comprising EBR's relationships with three service providers and four customers (two of each in the Commercial Area and two in the

Executive Area), as illustrated in table 1. For reasons of confidentiality, the names of the companies and managers in this study have been disguised.

Triad's Identification	MANUFACTURING FIRM	CUSTOMER	SERVICE PROVIDER (THIRD PART)
<b>COMMERCIAL AVIATION</b>			
T1	EBR	C1	SP1 (maintenance and repair services)
T2	EBR	C2	SP1 (maintenance and repair services)
<b>EXECUTIVE AVIATION</b>			
T3	EBR	C3	SP2 (maintenance and repair services)
T4	EBR	C4	SP3 (maintenance and repair services)

**Table 1: Triadic research cases**  
**Source: authors**

Trying to observe even the relationships of different service providers with customers, two triads were observed in the area of commercial aviation and two in the area of executive aviation. Data were collected from visits and interviews with managers. In each firm, at least one manager was interviewed (even within EBR), seeking to identify managers who had more knowledge about the relationship established.

Three interview scripts were prepared: one for application to the aircraft industry, another for interviews with service providers and a third adapted to customers' interviews. Initially, the triads were identified through interviews with managers in the aircraft industry. Based on this identification, managers of service providers and customers were contacted and visits were realized for the interviews. Following the case study analysis method recommended by Yin (2003), and inspired by the grounded theory approach suggested by Strauss and Corbin (Strauss, 1987; Strauss and Corbin, 1990), the data collected through in depth interviews were systematically transcribed and subjected to content analysis (Krippendorff, 2004). A pre-analysis stage consisted of preparing the interview material, with the transcript of the tapes of the respondents' comments. At the analysis stage, units used for content analysis purposes were sentences, paragraphs and phrases. Selected quotes from respondents were also used to capture the reality of the situation. Open coding was conducted by noting comments in each interview, with the focus on managers describing the evolution of relationships and critical events for this. The comments from each of the interviewee were then compared. The comments were summarized as keywords and phrases in order to be able to identify similarities and differences of ideas. Secondary material was also analyzed.

## RESULTS

To achieve the aim of this research, we present below the results for the analysis of data collected through interviews with managers of the four triads identified. As described in methodology, the answer for the script's open questions were transcribed and subjected to

content analysis (Krippendorff, 2004). Secondary material, such as business contracts and other technical documentation, was also analyzed.

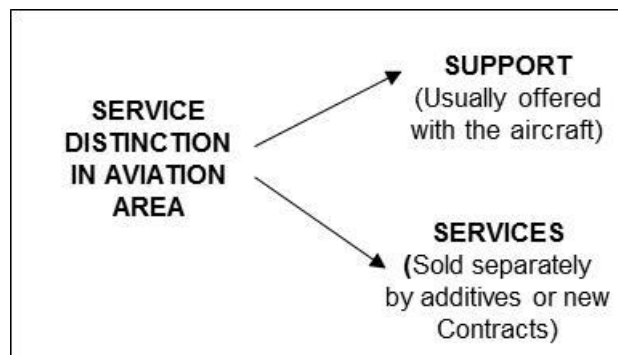
### **Presenting the case of EBR: understanding product/service combination in complex engineering service system**

EBR is one of the world's largest aircraft manufacturers. It has more than 40 years' experience in the design, manufacture, sales and support of aircraft. It has built more than 5,000 aircraft and operates in 88 countries over the five continents. EBR has expanded its activities to compete in the global market, offering aircraft across three segments: commercial, defence and executive aviation. EBR produces specific aircraft and, at the same time, offers packaged services specific to the requirement of each segment. For this, EBR has headquarters and offices, subsidiaries and customer service facilities worldwide. To help support its customers, EBR has developed a portfolio of 'Aviation Services', covering aircraft maintenance, spare parts, training and aeronautical systems. Alongside these fully owned units, EBR also outsources to qualified workshops and parts warehouses in another countries. The Aviation Services unit is organised by activity: Field Support, Technical Support, Maintenance Engineering, Operational Support, Maintenance Services, Material Support, Technical Publications and Training.

In 2009, the Commercial aviation segment represented the firm's greatest revenue generating segment (67%), followed by Executive aviation (9%), Services and Others (14%) and Defence systems (10%). In other words, customer support activities generate more revenues than Defence systems.

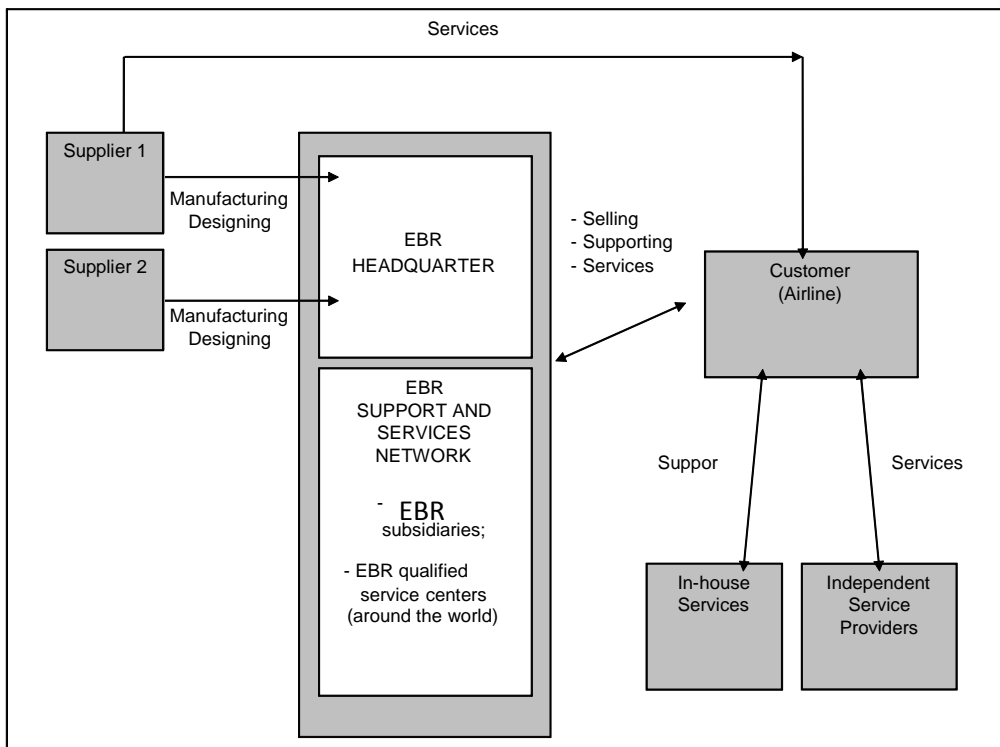
“An aircraft is a high performance product that has to meet customer needs, comfort, range and speed. Services also have to meet these requirements. Sometimes support services come as an expanded product. Services typically require dedicated staff, global presence and a broad and competitive portfolio” (interviewee of EBR in Triad 1).

Alongside its offer of specific aircraft, EBR has a variety of products and services to cater for customers' requirements. EBR differentiates between different types of Aviation Services activities, namely “support” and “services” activities. As confirmed by interviewee EMB02, the aviation industry usually categorizes as “support” those services that are delivered simultaneous with the purchase of the aircraft, and as “services” those that are sold separately:



**Figure 3: Service distinction in Aerospace Industry**  
Source: authors

When the aircraft is already in operation, customers can access services in different ways: EBR aviation services, in-house services or independent service providers. Contractual agreements between EBR and the airline can include different services. Generally, support services are already offered in conjunction with the aircraft, but other specific services can be negotiated separately. Consequently, the network built around the supply of products co-exists with a network related to service provision. At EBR, then, a network has emerged which includes not only customers and suppliers, but also suppliers' suppliers. Both product and service networks exist interdependently in order to co-create value for all members of the network (see Figure 4). Figure 4 below illustrates relationships developed between firms and types of services exchanged:



**Figure 4: EBR Service Provision System**  
**Source: authors**

The initial business contract established is the General Terms of Agreements (GTA), providing the regulation of services that are provided to support aircrafts. Usually, initial contracts are developed establishing the relationships between the Manufacturing Firm and the Service Provider and the Manufacturing Firm and the Customer. In the initial contract established between the Manufacturing Firm and the Service Provider, the firms prepare a formal agreement to reach mutual understanding as regards the meaning of the relationship and the benefits to be gained from the contractual agreement in question. Manufacturing firms usually wants to certify that the Service Provider will provide quality services to attend customer's needs. But according the interviewee from the service provider firm in Triad 1 , "it's impossible to describe everything in just one contract". With the development of relations between firms, new services can be identified and additives or another business contracts can be established. For

the other side, the initial business contract established between Manufacturing Firm and the Customer is also registered by a GTA. In this contract, the aircraft's features are defined and also all services, equipment and resources that are necessary for the support of the aircraft over time. Services in these contracts are related to supporting services, mainly maintenance and repair activities. According to the interviewee of the Service Provider in Triad 4, "the GTA can establish the guidelines, but additional services can be negotiated over time". Analysing relationships in the four triads of this case study, we identified: 1) how the types of business contracts that are established by these firms and how do the firms effectively manage the tradability of goods and services in contracts. Table 2 below summarizes the results:

CASES (TRIADS)			TYPE OF CONTRACT	HOW GOODS AND SERVICES ARE CONSIDERED?		
				INITIAL AGREEMENT (SUPPORTING)	CONTRACT'S ADDITIVES (SERVICES SOLD SEPARATELY)	
COMMERCIAL AVIATION	T1 T2	EBR	SP1	Relational Contract Relational Contract	The service provider is qualified for the provision of services related to supporting activities. This supporting services are developed in order to attend terms of guarantess, described in the Embraer-Customer initial agreement.	The manufacturing firm can consider the service provider as a supplier of new services sold to Customers. Additives to initial contract can be developed for this.
		EBR	C1 C2	Relational Contract Relational Contract	GTA (General Terms Agreement) is established. Aircrafts, as a good, are described in details. Services are also described as related to maintenance and repair, in order to support terms of guarantee.	The Manufacturing Firm can sell new services in order to improve the aircraft over time. Additives to initial contract are considered.
		SP1	C1 C2	Relational Contract Relational Contract	The Customer establishes a relation with the Service Provider considering this as a qualified service center of the Manufacturing Firm. A business contract is signed for the provision of mainetence and repair services. The services related to guarantee are paid by the Manufacturing Firm.	Customer and Service Provider can also establish an independent relation. This occurs when the period for guararantee is over. The Customer can remain accessing maintenance and repair services or also developing new services directly with the service provider. New business contracts or additives are developed for this.
		EBR-SP1-C1 EBR - SP1 -C2		There isn't a mutual contract for the three firms. The Customer can choose the Service Provider by itself.	Relations established between Manufacturing firm and the Service Provider works as a guideline for the relation developed between Service Provider and Customer. But there isn't a mutual business contract involving the three firms.	New services can be developed by integrated relationships. For this, new business contracts or additives are developed.

CASES (TRIADS)		TYPE OF CONTRACT		INITIAL AGREEMENT (SUPPORTING)	CONTRACT'S ADDITIVES (SERVICES SOLD SEPARATELY)	
EXECUTIVE AVIATION	T3 T4	EBR	SP2 SP3	Relational Contract Relational Contract	The service provider is qualified for the provision of services related to supporting activities. This supporting services are developed in order to attend terms of guarantess, described in the Embraer-Customer initial agreement.	The manufacturing firm can consider the service provider as a supplier of new services sold to Customers. Additives to initial contract can be developed for this.
		EBR	C3 C4	Relational Contract Relational Contract	GTA (General Terms Agreement) is established. Aircrafts, as a good, are described in details. Services are also described as related to maintenance and repair, in order to support terms of guarantee.	The Manufacturing Firm can sell new services in order to improve the aircraft over time. Additives to initial contract are considered. But in Executive Aviation the Customer establishes less intensive relations then in Commercial Area.
		SP2 SP3	C3 C4	Transactional or Relational Contract in both cases	The Customer establishes a relation with the Service Provider considering this as a qualified service center of the Manufacturing Firm. A business contract is signed for the provision of mainetence and repair services. The services related to guarantee are paid by the Manufacturing Firm.	Customer and Service Provider can also establish an independent relation. This occurs when the period for guarantee is over. The Customer can remain accessing maintenance and repair services or also developing new services directly with the service provider. New business contracts (transactional or relational) or additives are developed for this.
		EBR-SP2-C3 EBR - SP3 -C4		There isn't a mutual contract for the three firms. The Customer can choose the Service Provider by itself.		Relations established between Manufacturing firm and the Service Provider works as a guideline for the relation developed between Service Provider and Customer. But there isn't a mutual business contract involving the three firms.

**Table 2: Business contracts, products and services in each case.**  
Source: authors

According to table 2, the two Commercial Aviation sector triads presented similar configurations, and some differences were observed in the Executive Sector. The aircraft manufacturing involves high technology, high complexity and development of a global business network able to support the operationalization of the product over time. All triads identified in

this study were established to meet the needs of firms for the offer and/or access to services. When a customer decides to buy an aircraft, this decision presupposes the development of a long term relationship with the manufacturer. The aircraft is a long lasting product and requires constant maintenance and updates by the manufacturer. That is, the relationship between Industry-Customer in this area is long term and usually implies in high interaction. The relationship with the service provider is established because the industry does not provide direct customer service (or provides it with unlimited capacity).

In all relationships identified in this work, customers are free to choose the service providers. The industry indicates qualified service suppliers of its network, but customers can choose whether or not to establish relationships with these firms. Thus, relations are established by business contracts signed between dyads (Industry-Service Provider; Industry-Customer; Service Provider-Customer), but they can be undone if some part perceives value in other forms of access to services. The analysis of interviews in the four service triads confirmed that services are provided, initially, to support the aircraft, but subsequently for its improvement. In the Commercial Sector, as the Customer usually has a fleet with many aircraft, the relationship established with the Service Provider is more intensive than in the case of the Executive Sector. This characteristic of the Commercial Sector implies that is more usual to have the development of new services by triadic interfaces in this area. On the other hand, the Customer in the Executive Sector can establish relationships with more intimacy with the Service provider or can change for another easier one. Thus, relational or transactions contracts can be developed in order to attend to customer needs, and the provision of services are distinguished.

## **DISCUSSION**

Taking triadic interaction as the building block of a network (Choi and Wu, 2009), the case of EBR and its partners highlights interesting issues about the tradability of product-service arrangements. Considering that products and services require ‘stabilization’ and ‘objectification’ (Callon et al, 2002) to be transacted, the analysis of business contracts can be useful to give evidences about the management of solutions. The case of EBR and its partners shows that long term relationships established in contracts assumes the mobilization of actors, integration of activities, interchange of resources and update of technologies, allowing the provision of services over time. This case contributes to the discussion about how manufacturing firms can generate revenues from a variety of revenue streams over time.

EBR describes itself as a company that works in designing, manufacturing, selling and supporting aircraft for the global airline. Considering products and services as related to producer-user interaction (Hill 1977, 1999; Delaunay and Gadrey 1987; Gadrey, 2000 and Spring and Araújo, 2009), the combination of products and services by EBR can be understood according Bryson et al (2004), for which manufacturing and services have: I) become increasingly complementary and II) mutually support activities. Firstly, EBR offers services (as designing, selling and supporting activities) and products (manufactured aircrafts) in a complementary way, in order to attend aviation markets. For the other side, EBR also offers services by support activities (Aviation Services), in order to support its customers and provide after-sales service. This service and business unit encompass aircraft maintenance, spare parts, training and aeronautical systems, which increase the value of use of the EBR products, i.e. the aircraft. Thus, EBR Aviation Services are developed to provide continuous added value to

customers and provide evidence of Lusch et al (2010) ideas about service as processes for value creation by resource interactions among parties in relationships. This dynamic portfolio of services shows how value in exchange and value in use are both important issues for managing value creation processes.

Analysing business contracts established between firms in complex engineering service system is a way to clarify how the tradability of goods and services are being managed by firms in this context. In order to reduce or minimise uncertainty and risks between the parties in business relationships (Williamson, 1975, Roxenhall and Ghauri 2004), the data shows that relations are established by business contracts signed between dyads (Industry-Service Provider; Industry-Customer; Service Provider-Customer). Here there is a point to highlight about how to manage the offer of product-service combination in complex engineering service systems. The initial contract established (GTA) between the Manufacturing firm and the Customer is developed around services associated to the aircraft, as supporting (maintenance and repair). Guarantee services are described to ensure the operation of the aircraft. But additional clauses can be described in contracts for the provision of other services that are sold separately. So, business contracts are used as a formal document describing the requirements of accepted practice in a given business setting (Roxenhall and Ghauri, 2004; Roxenhall, 1999). EBR offers a range of services sold together with the aircraft, and others sold separately, depending on customer needs.

Acquiring an EBR aircraft, customer involves many different kinds of support and after-sales services that can be also developed in collaboration, by a dedicated team in order to provide added value. 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 EBR(s Aviation Services business unit. Based on the notion of “service encapsulation” (Howells, 2000), EBR can be seen as a company providing manufactured products with closely aligned services. In this way, in line with Bryson et al’s (2004) concept for four different forms to manufacturing companies transforming themselves into either partial service companies or complete service companies, we can understand EBR as a service-manufacturing company: EBR produces 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 EBR, customers and suppliers relationships. Business contracts in complex engineering service systems can be used as a tool for the integration among firms in order to allow the provision of solutions.

## **FINAL CONSIDERATIONS**

This research was developed in order to describe how manufacturing firms of complex engineering products manage the offer of services in their business contracts. A qualitative and exploratory research design, developed by a multiple case study approach in aerospace industry, (Yin, 2003) was adopted showing evidences about how firms in this context manage the tradability of services. First, the data describe how firms in aerospace industry establish their business contracts involving customers and suppliers in order to consider the provision of services. Despite the fact that the value proposition of the manufacturing firm can be understood

as the combination of products and services, the data show that manufacturing firms in aerospace industry established a distinction between services related to support (maintenance and repair) and other types of services offered to their customers. In order to manage the service tradability, services understood as support are offered, essentially, since the initial contract, as a fundamental condition for the aircraft's operation. But there are other types of services that can be sold separately, and these other services are useful for profitability and differentiation.

The paper contributes to the discussion about how manufacturing firms of complex engineering products can offer the combination of products and services (as mixed offerings) in their business contracts. Considering the nature of producer-user interactions and the institutional structure of production and networks, the paper describes ways in which firms can manage the tradability of services over time, offering continuous value propositions. The analysis done can be useful for managers providing a better view about how relationships are developed in the context of complex engineering service system. Being a case study, this research has limits as it regards the generalizability of conclusions. Further research can be developed considering another type of relationships in complex engineering service system. Other service providers can be considered, and also services that are provide by suppliers of goods (not service suppliers).

### **ACKNOWLEDGEMENT**

The author João Proença thanks Fundação para a Ciência e Tecnologia (FCT Portugal) for financial support to ADVANCE by the Multi-Year Funding Program for R&D Units.

### **REFERENCES**

- Araújo, L., & Spring, M. (2006). Services, products and the institutional structure of production. *Industrial Marketing and Management*, 35(7), 797-805.
- Berry, L.; Parasuraman, A. Marketing Services: Competing Through Quality. *The Free Press*: New York, 1991.
- Brown, J.R. Cobb, A.T. and Lusch, R.F. (2006). The roles played by interorganizational contracts and justice in marketing channel relationships. *Journal of Business Research*, 59, (2), 166-175.
- Bryson, J., Daniels, P., & Warf, B. (2004). *Service world: people, organisations, technologies*. New York: Routledge.
- Byrne, D., & Ragin, C. (2009). *The Sage handbook of case-based methods*. London: Sage Publications.
- Callon, M., Meadel, C. and Rabeharisoa, V. (2002), "The economy of qualities", *Economy and Society*, Vol. 31, No. 2, pp. 194-217.

Campbell-Kelly, M., & Garcia-Swartz, D. D. (2007). From products to services: the software industry in the internet era. *Business History Review*, 81(4), 735-764.

Chesbrough, H., & Rosenbloom, R. S. (2002). The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change*, 11(3), 529-555.

Choi, T.Y., Wu, Z. (2009), Taking the leap from dyads to triads: buyer-supplier relationships in supply networks. *Journal of Purchasing and Supply Management*, 15 (4), 263-266.

Cornet, E., Katz, R., Molloy, R., Schädler, J., Sharma, D. and Tipping, A. (2000), *Customer solutions: from pilots to profits*, Viewpoint, Booz-Allen & Hamilton, Chicago.

Cova, B. and Salle, R. (2008a), "Creating superior value through network offerings", In Woodside, A., Golfetto, F. and Gibbert, M. (Eds), *Advances in Business Marketing and Purchasing*, Vol. 14, Emerald Group, Bingley, pp. 317-342.

Cova, B. and Salle, R. (2008b), "Marketing solutions in accordance with the S-D logic: co-creating value with customer network actors", *Industrial Marketing Management*, Vol. 37, No. 3, pp. 245-350.

Davies, A., Brady, T. & Hobday, M. (2006). Charting a path towards integrated solutions. *MIT Sloan Management Review*, 47(3), 39-48.

Delaunay, J.C. and Gadrey, J. (1987). *Les Enjeux de la Société de Service*. Paris, Presses de la Fondation nationale des Sciences Politiques.

Fisk, R. P.; Brown, S. W.; Bitner, M. J. (1993), Tracking the evolution of the services marketing literature," *Journal of Retailing*, 69 (Spring), pp.61-103.

Ford, D., Gadde, L-E., Håkansson, H., & Snehota, I. (2003). *Managing business relationships*. (3rd ed.). Chichester: John Wiley & Sons.

Gadrey, J. (2000). The characterization of goods and services: an alternative approach. *Review of Income and Wealth*, 46(3), 369-387.

Gebauer, H. (2008). Identifying service strategies in product manufacturing companies by exploring environment-strategy configurations. *Industrial Marketing Management*, 37(3), 245-350.

Grönroos, C. (2006), "Adopting a service logic for marketing", *Marketing Theory*, Vol.6, No. 3, pp. 317-333.

Grönroos, C. (2007). *Service management and marketing: customer management in service competition*. (3rd ed.). Chichester: John Wiley & Sons.

- Grönroos, C.; Gummesson, E. (1985) The Nordic School of Services – an introduction. In: Grönroos, C.; Gummesson, E. (eds) *Service Marketing- Nordic School Perspectives*, Series R2, pp.6-11. Stockholm: University of Stockholm.
- Hart, O. and Holmström, B. (1987) *The theory of Contracts*, University Press, Cambridge.
- Helander, A. and Möller, K. (2007), “System supplier`s customer strategy”, *Industrial Marketing and Management*, Vol. 36, No. 6, p 719-730.
- Hill, P. (1977). On goods and services. *Review of Income and Wealth*, Vol 23, N° 4, pp. 315-338.
- Hill, P. (1999). Tangibles, intangibles and services: a new taxonomy for the classification of output. *Canadian Journal of Economics*, Vol. 32, N° 2, pp. 426-447.
- Howells, J. (2000), *Services in the knowledge economy*, Edward Elgar: Cheltenham.
- Kapletia, D., & Probert, D. (2010). Migrating from products to solutions: an exploration of system support in the UK defense industry. *Industrial Marketing Management*, 39(4) 582-592.
- Kindstrom, D. (2010). Towards a service-based business model: key aspects for future competitive advantage. *European Management Journal*, 28(6), 479-490.
- Krippendorff, K. (2004), *Content analysis: an introduction to its methodology*, 2nd ed., Sage, Thousand Oaks.
- Lovelock, C.; Gummesson, E. (2004). Whither Services Marketing?: In Search of a New Paradigm and Fresh Perspectives. *Journal of Service Research*; Volume 7, No. 1, 20-41, August.
- Macaulay, S. (1963), “The use and non-use of contracts in the manufacturing industry”, *The Practical Lawyer*, Vol. 9, No. 7, pp. 13-39.
- Macneil, I. R. (1978), *Contracts – exchange transactions and relations*, The foundation Press Inc. Mineola, New York, USA.
- Mouzas, S. (2006), “Negotiating umbrella agreements”, *Negotiation Journal*, Vol. 22 No. 3, pp. 279-302.
- Mouzas, S., and Ford, D. (2006), “Managing relationships in showery weather: The role of umbrella agreements”, *Journal of Business Research*, Vol. 59, pp. 1248-1256
- Mouzas, S., and Ford, D. (2007), “Contracting in Asymmetric Relationships: The Role of Framework Contracts”, *The IMP Journal*, Vol. 1, No 3, pp 42-63.

- Narula, R. and Hagedoorn, J. (1999), "Innovating through strategic alliances: moving towards international partnerships and contractual agreements", *Technovation*, Vol.19, Issue 5, pp. 283-294.
- Ng, I. C. L., Parry, G., Smith, L. and Maull, R. and Briscoe, G. (2012), "Transitioning from a goods-dominant to a service-dominant logic: visualising the value proposition of Rolls-Royce", *Journal of Service Management*, Vol. 23, No. 3, pp. 416-439.
- Ng, I. C. L., Parry, G., Wild, P., McFarlane, D. and Tasker, P. (Eds.) (2011), *Complex engineering service systems*, Springer, London.
- Nordin, F., & Kowalkowski, C. (2010). Solution offerings: a critical review and reconceptualisation. *Journal of Service Management*, 21(4), 441-459.
- Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160-172.
- Peng, T. A., Lin, N., Martinez, V. and Yu, C. J. (2010), "Managing triads in a military avionics service maintenance network in Taiwan", *International Journal of Operations & Production Management*, Vol. 30, No. 4, pp. 398-422.
- Ragin, C. (1992). "Casin" and the process of social enquiry. In Ragin, C., & Becker, H. (Eds.), *What is a case?: exploring the foundations of social enquiry* (pp. 217-226). Cambridge, New York: Cambridge University Press.
- Reinartz, W.; Ulaga, W. (2008). How to sell services more profitably. *Harvard Business Review*, may, p. 91-96.
- Roxenhall, T. (1999), *The use of the Written Business Contract*, Dis, Uppsala, Reprocentralen, Ekonomikum, Uppsala. (in Swedish).
- Roxenhall, T. and Ghauri, P. (2004), "Use of the written contract in long-lasting business relationships", *Industrial Marketing Management*, Vol. 33 Issue 3, pp. 261-268.
- Salonen, A. (2011), "Service transition strategies of industrial manufacturers", *Industrial Marketing Management*, Vol. 40, No. 5, pp. 683-690.
- Seshadri, S. and Mishra, R., (2004), "Relationship marketing and contract theory", *Industrial Marketing Management*, Vol.,33, pp. 513-526.
- Sheth, J. N., & Sharma, A. (2008). The impact of the product to service shift in industrial markets and the evolution of the sales organization. *Industrial Marketing Management*, 37(3), 260-269.

Spring, M. and Araújo, L. (2009), "Service, services and products: rethinking operations strategy", *International Journal of Operations & Production Management*, Vol. 29, No. 5, pp. 444-467.

Strauss, A. (1987), *Qualitative Analysis for Social Scientists*, Cambridge University Press, New York, NY.

Strauss, A. and Corbin, J. (1990), *Basics of Qualitative Research – Grounded Theory Procedures and Techniques*, Sage, Newbury Park, CA.

Teboul, J. (2006). *Service is front stage: positioning services for value advantage*. London: Insead, Palgrave Macmillan.

Tuli, K. R., Kohli, A. K., & Bharadwaj, S. G. (2007). Rethinking customer solutions: from product bundles to relational processes. *Journal of Marketing*, 71(3), 1-17.

Van Der Valk, W. (2008). Service procurement in manufacturing companies: results of three embedded case studies. *Industrial Marketing Management*, 37(3), 245-350.

Vargo, S.L; Lusch, R.F. (2008). Service-dominant logic: continuing the evolution. *Journal of the Academy of Marketing Science*, 36: 1-10.

Vargo, S.L; Lusch, R.F.. (2004). Envolving to a New Dominant Logic of Marketing. *Journal of Marketing*, v.68, n.1, p. 1-17, jan.

Vedel, M., Geersbro, J. and Ritter, T. (2012), "Interconnected levels of multi-stage-marketing: a triadic approach", *Journal of Business Market Management*, Vol. 5, No. 1, pp. 1-20.

Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. The Free Press, New York

Yin, R. K. (2003), *Case study research: design and methods*, Applied Social Research Methods Series, Vol. 5, 3th ed., Sage Publications, London.