UNIVERSITÀ DEGLI STUDI DI BERGAMO

Faculty of Economics and Business Administration

PhD in Logistics and Supply Chain Management

XXIV Cycle

# DESIGNING AND CONFIGURING THE VALUE CREATION NETWORK FOR SERVITIZATION: A PRODUCT-SERVICE PROVIDER'S PERSPECTIVE

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*"... fatti non foste a viver come bruti,*
*ma per seguir virtute e canoscenza"*

*Dante Alighieri*

*Divina Commedia, Inferno canto XXVI, 116-120*

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It is always touching to look behind your shoulder when you arrive at the end of a long journey. Becoming a PhD is not only part of a professional career, but it is above all a walk of life, a way to grow and mature as a person. I think I did. But it would not be possible with the help and the support of the persons I met during these three years, and with who I have shared my research, my work, my fears, my hopes and my dreams. That is why I want to thank you all.

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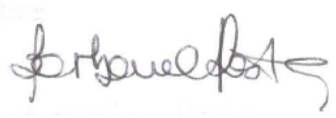
Bergamo, February 2012



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# 1 Introduction

The current situation that manufacturing firms are facing is characterised by a fierce global competition, as well as by the saturation and commoditisation of their core product markets (Vandermerwe and Rada, 1988; Matthyssens and Vandenbempt, 2008; Gebauer, 2008), with consequent negative effects on product sales and margins (Wise and Baumgartner, 1999; Cohen et al., 2006). In addition, customer needs and expectations are becoming more complex and comprehensive (Mathieu, 2001a; Gebauer et al., 2008), often based on what a product does for the user, not on the product itself (Sawhney et al., 2004; Stahel, 1997; Mont, 2002), and on an "expectation of benefits" (Levitt 1969).

The combination of these factors has pushed companies to move beyond manufacturing, towards the service arena (Vandermerwe and Rada, 1988; Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Neely, 2009; Wilson, 2008). This transformation has been happening since the early 1990s (Davies et al., 2006), when most manufactures started to offer services to varying degrees (Mathieu, 2001b). Recently, a study by Lay et al. (2010) suggested that more than 85% of European manufacturing companies offer at least one type of service.

There are several reasons why services are attractive for manufacturing firms, as summarised by Mathieu (2001b) and further refined by other authors (e.g. Baines et al., 2009). These benefits can be grouped into three main categories:

- Financial – Services increase the generation of sustainable revenues from the installed base of products over their life cycle (Potts, 1998; Wise and Baumgartner; 1999; Cohen et al., 2006; Slack, 2005; Sawhney et al., 2004). In addition, sales of services are to some extent counter-cyclical to sales of products (Wise and Baumgartner; 1999; Davies, 2003), and tend to be less sensitive to price-based competition (Malleret, 2006), thus reducing the volatility of cash flow (Brax, 2005; Malleret, 2006).
- Strategic - Services can be an important source of competitive advantages and a way to differentiate products (Frambach et al., 1997; Gebauer and Friedli, 2005;

Kyj and Kyj, 1994). It is especially true for mature industries, where market expansion and technological innovation are relatively slow (Oliva and Kallenberg, 2003) and are characterised by a high installed-base-to-new-unit ratio (Wise and Baumgartner, 1999). Moreover, services can support companies in building up barriers to entry, and making market penetration by potential new competitors more difficult (Mathe and Shapiro, 1993).

- Marketing - Services can be an argument for using services to sell more products (Mathe and Shapiro, 1993; Gebauer and Fleisch, 2007), increasing first-time and repeat sales, and thus gaining market share (Cohen and Lee, 1990). Moreover, services are a mean to tailor the offering (Anderson and Narus, 1995) and enhance customer loyalty (Correa et al., 2007).

Furthermore, potential environmental benefits of decoupling ownership of assets and use through the introduction of product-service combinations are mentioned in literature (Mont, 2002).

## 1.1 Some successful examples

In real life, there are several successful stories of traditional manufacturing companies that became product-service providers.

One of the pioneering company is Xerox, that in 90's started to move from selling printers and copiers to offering solutions based on the payment of a fixed price per copy (pay-per-page), up to the delivery of document management systems. In 1994 a partially digitized red "X" made its debut as the new corporate symbol, supported by a signature underscoring the leadership position: "The Document Company – Xerox" (www.xerox.com).

In the personal computer sector, IBM has fundamentally reinvented itself as service businesses, moving away from the production of hardware to offer business solutions. The journey started in 1993, under Lou Gerstner, with the creation of a front-end called IBM Global Industries. In 2001 the revenues IBM obtained from services (43%) overtook hardware and technology (42%) for the first time in the firm's history (Gerstner, 2002).

Since the mid-1990's, Alstom Transport division has tackled a strategy to evolve from a "seller of goods to a system and service provider" (Owen, 1997), providing to its

customers complete transport solutions based on train availability along the entire life cycle of the system.

Another example is the case of the ICI-Nobel Explosives Company in the UK. Until the early 1990s, the company had focused its business on the production of explosives for coal mining, but its fortunes had declined with the reduction of the market. In order to survive, the company innovated its offering, providing quarries with a complete service (planning the blast, drilling holes, inserting the explosive and firing the blast): "The quarry did not pay for the explosive anymore. Rather, it paid for the 'rock on the ground' that the ICI-Nobel company provided as a service". (Schmenner, 2009).

Probably, the most known case is Rolls-Royce that no longer simply sells aero engines, but offers gas turbine engines to some airlines companies by providing 'power-by-the-hour' services, retaining responsibility for risk and maintenance and generating revenues by making the engine available for use, basically "selling hot air out the back of an engine" (The Economist, 2009).

Many similar examples can be drawn from a wide variety of industries, both in Business to Business (B2B) and Business to Consumer (B2C) contexts.

In literature, this phenomenon is usually called *servitization* (Vandermerwe and Rada, 1988).

## 1.2 The "service paradox"

However, all that glitter is not gold.

Despite the successful stories previously described, many manufacturing firms have struggled to succeed in the service realm. The ''service paradox in manufacturing companies'' is an expression coined by Gebauer, Fleisch and Friedli (2005) to describe the failure of the growth in service to meet its intended objectives. Many product manufacturers invested heavily in extending their service business, without obtaining the expected correspondingly higher returns. This phenomenon was empirically investigated by Neely (2008), who demonstrated that *servitised* firms generate higher revenues but deliver lower profits than pure manufacturing firms. Basically, he observed that considerably more of the servitized firms in the sample had declared bankruptcy than might be expected. Indeed, while the sample as a whole comprised 31,55% (3,309) *servitized* firms, of the 212 firms that had declared bankruptcy, 113

(53,3%) had *servitized* and only 99 (46,7%) were pure manufacturers. Different results were obtained by Fang et al. (2008), who stated that transitioning to services positively affects firm value, but with two important caveats: i) the effects on firm value become pronounced only after the level of service sales reaches a critical mass, which averages approximately 20%–30% of total firm sales; an ii) the effects of service sales on firm value are highly contingent on the firm and industry.

Even if further empirical research is needed to investigate the impact of a firm's service transition strategy on its value and profitability, it is clear that this evolutionary journey is fraught with difficulties and involves several challenges for a manufacturing company (Martinez et al., 2010):

- promotion of an embedded product-service culture;
- delivery of integrated offering;
- acquisition of new capabilities and alignment of processes supporting design and changes of product and service;
- strategic alignment of mindset and understanding towards service provision;
- greater degree of cooperation between a provider and its supporting network of suppliers.

It is not enough just to innovate the offering introducing new services and solutions, but further changes in all areas of a company's business model are required, in an organic, structured and coherent fashion (Kindström, 2010). Modifications are needed not only internally, but also externally, downstream towards customers, and upstream towards suppliers and partners.

## 1.3 Purpose of the research

Based on this discussion, the general purpose of this doctoral thesis is to understand how manufacturing firms can successfully provide Product-Service (PS) offerings to the customers. In particular, it is of interest to understand what are the different dimensions that need to be considered to analyse a PS offerings and what value they assume in accordance with different level of *servitization*. Moreover, the thesis aims at investigating how these different dimensions impact on the business model of a manufacturing company that provide such offerings, in particular on its resources, competences, organisational features and network relationships.

## 1.4 Outline of the thesis

This doctoral thesis consists of seven chapters, organised as follows.

Chapter 1 (this chapter) briefly introduces and the main feature of the current manufacturing world and the topic of discussion, presenting the overall purpose of the thesis.

In Chapter 2 a systematic literature review of the *servitization* field and its related research areas is proposed.

Chapter 3 closes the conceptual section of the thesis through the development of the conceptual research model and the discussion of the research design and research process.

Chapter 4 is devoted to the description of the adopted methodological approach and of the research design.

Chapter 5 presents the four case studies investigated, and offers a "with-in analysis" for each case.

Chapter 6 then discusses and compares the empirical results from each case ("cross-case analysis), and presents the research findings.

Chapter 7 concludes with a summary of the research contribution, managerial implications, and suggestions for future research.

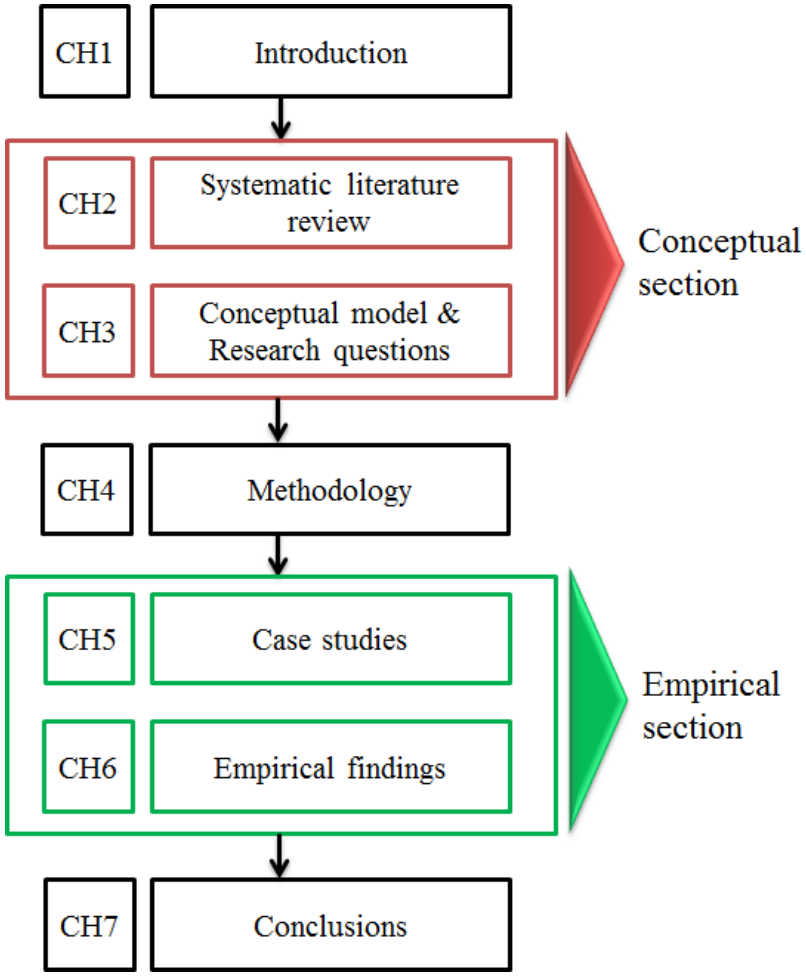


**Figure 1: Thesis outline**

Preliminary results have been presented during the Ph.D. course, on the occasion of several international conferences and doctoral workshops related to the Operations Management field, as show in Table 1.

| **Chapter** | **Author(s)** | **Title** | **Conference/Doctoral Workshop** |
|---|---|---|---|
| 2 | Resta, B. | Sustainable Product Service System: a conceptual framework | Doctoral Spring Workshop "Product and Asset Lifecycle Management" (DSW-PALM), 17-19 May, Islantilla (Spain). |
| 3 | Gaiardelli, P. and Resta, B. | Key variables characterising a sustainable PSS business model: evidences from | XV Summer School "Francesco Turco" Impianti Industriali Meccanici, "Sustainable Development: Industrial Practice, Education |

| | | | |
|---|---|---|---|
| | | literature | & Research", 14-17 September 2010, Porto Giardino (Italy). |
| 3 | Resta, B. and Gaiardelli, P. | Sustainable Product Service System: a conceptual framework | APMS 2010, International Conference on Advances in Production Management Systems, "Competitive and Sustainable Manufacturing, Products and Services", 11-13 October 2010, Cernobbio (Italy). |
| 3 | Resta, B. | Sustainable Product Service System: a conceptual framework | Doctoral Workshop of the APMS 2010, International Conference on Advances in Production Management Systems, "Competitive and Sustainable Manufacturing, Products and Services", 9-10 October 2010, Cernobbio (Italy). |
| 3 | Gaiardelli, P., Resta, B. and Martinez, V. | A new product-service offering taxonomy: an application to the Italian truck industry | 3rd International EurOMA Service Operations Management Forum (SOMF): "New Directions in Service Operations Management", 20-21 September 2010, Bath (UK). |
| 3/4 | Resta, B. | Sustainable Product-Service System: a conceptual framework | Doctoral Spring Workshop "Product and Asset Lifecycle Management" (DSW-PALM), 9-10 May, 2011, Rosiers (France) |
| 5 | Resta, B., Gaiardelli P., Pezzotta, G., and Songini, L. | Configure the service network managing inter-firm relationships | 18th EurOMA Conference "Exploring Interfaces", 3-6 July 2011, Cambridge (UK). |
| 5 | Songini, L., Gaiardelli P., Pezzotta, G., and Resta, B. | Servitization strategy and performance measurement systems: evidences from Italian truck industry | 6th Conference on Performance Measurement and Management Control, 7-9 September 2011, Nice (France). |

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| 5 | Gaiardelli, P., Resta, B., Songini, L. and Pezzotta, G. | Aligning the servitization level of a company with its organisational configuration | APMS 2011, International Conference on Advances in Production Management Systems, "Value Networks: innovation technologies and management", 25-28 September 2011, Stavanger (Norway). |
| 5 | Resta, B. and Gaiardelli, P. | Organising for servitizing: a PSS provider's perspective | 4th EurOMA Service Operation Management Forum, 19-20 September 2011, Florence (Italy). |

**Table 1: Papers presented during the Ph.D. programme**

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# 2 The *servitization* of manufacturing: a systematic literature review

Even if there is considerable and extensive research going on related to the *servitization* (or *servitisation*) phenomenon, there tend to be low agreement concerning key definitions and concepts, main features and methods to be used. Its fragmented and disaggregated nature is reflected in the existence of separate sub fields having their own distinct terminology, questions, hypotheses, methodologies, and conclusions. As argued by many authors, relevant concepts are in fact dispersed across a number of different disciplinary literatures, and what are their commonalities, their differences and how they are connected is still not clearly defined. Synthesising diverse research streams into a coherent picture and creating a common understanding that can serve both the research and practitioner communities therefore have become an increasing challenge.
The aim of the systematic literature review presented in this chapter is to create a common understanding of the phenomenon under investigation, its different facets and characteristics, in order to support the definition of the research questions and of the conceptual model which will further advance the knowledge base.

## 2.1 What is a systematic literature review?

"*A literature review is a systematic, explicit, and reproducible design for identifying, evaluating, and interpreting the existing body of recorded documents*" (Fink, 1998) aiming to (Croom, 2009):

- map, assess and summarise the existing state of knowledge;
- identify the conceptual content of the field and develop constructs, hypothesis and research questions;
- support the choice of a proper research methodology.

Compared to a traditional (or narrative) approach, systematic reviews use a more rigorous and systematic process to reviewing the literature in a specific subject area, according to scientific principles and rules (Hart, 1998, Magarey, 2001, Jesson et al., 2011). Since the application of these principles help to limit bias (systematic error), the expected result is a reliable (Greenhalgh, 1997) "research synthesis that can be replicated by others, can create consensus among scholars, and can focus debate in a constructive fashion" (Cooper, 1998).

The literature review on *servitization* (or *servitisation*) presented in this chapter is based on the National Health Service (NHS) Centre for Reviews and Disseminations guidance for undertaking systematic reviews (2001). Although the report has been written for those with an understanding of health research, its application is quite common also in other sciences such as psychology, nursing, physical therapy, educational research, sociology and business management. In particular, Tranfield et al. in their paper appeared in 2003 on the British Journal of Management, seek to tease out the key characteristics of this approach, highlighting the key challenges in transferring the model to the management field, and present a number of recommendations on how these may be addressed.

The core methods for carrying out any systematic review is based on a three-stage process, as depicted in Figure 2: planning, conducting, and reporting the review.

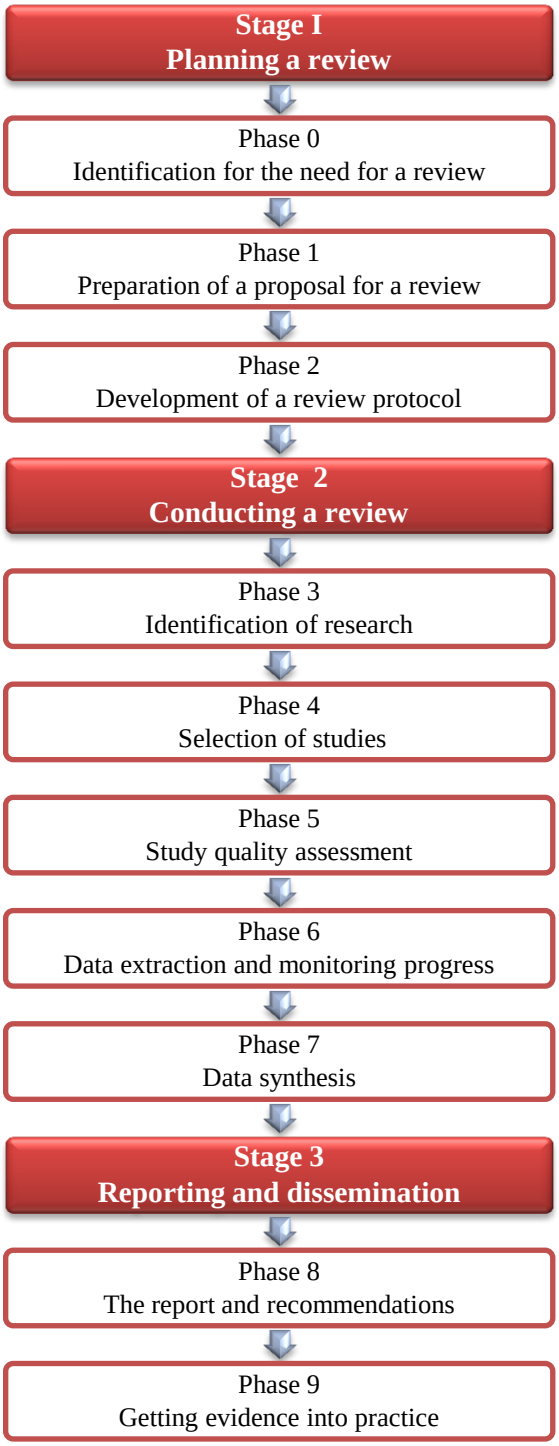



**Figure 2: Systematic literature review process (Tranfield et al., 2003)**

**Stage 1** consists of three phases: (Phase 0) the identification of a need for a systematic review of the literature, determining whether a similar review has been done previously; (Phase 1) the preparation of a proposal for a review, scoping and mapping of the extant literature; and (Phase 2) the specific review questions to be researched, followed by the development of a review protocol.

**Stage II** consists of the next five stages which describe the systematic review protocol in more detail. It begins with the identification of keywords and search terms, which are built from the scoping study and the literature (Phase 3). Phase 4 describes the method used to identify and select relevant studies for the review. Phase 5 then assesses the relevant studies for quality. Phase 6 provides a sample data extraction form used to collect data from relevant studies. Finally, phase 7 describes how the data have been synthesised.

**Stage III** includes Phase 8 which shows tables of descriptive and thematic analyses reports that were generated from data synthesis, while Phase 9 concludes with discussion, evidence and key learning points.

## 2.2 Stage I - Planning the review

### 2.2.1 Identification for the need for a review

Before undertaking a systematic review it is necessary to check whether there are already existing or on-going reviews, and whether a new review is justified. In order to determine whether a new review should be undertaken, a search for peer-reviewed journal articles in six academic databases[1] was carried out using the search string: (*servitization* OR *servitisation*) AND ('systematic review' OR 'systematic analysis' OR 'systematic literature review'). This process resulted in only one entry: *Velamuri, V.K., Neyer, A.K., and Möslein, K.M. (2011). Hybrid value creation: a systematic review of an evolving research area. Journal fur Betriebswirtschaft, 61, 3-35.*

The systematic review described in the paper analyses literature related to the field of 'hybrid value creation', defined as the process of generating additional value by innovatively combining products (tangible component) and services (intangible component). Based on 15 search terms (complex product system, customer solutions, dematerialisation, extended products, functional products, functional economy, hybrid product, hybrid solution, integrated solution, product based service, product related service, product service, product service system, *productization* and *servitization*), the authors identify 169 publications focusing on hybrid value creation as the basis of the literature review. The identified publications are then clustered into eight categories (Strategic, Organisational, Marketing, Design, Innovation, Business level, Sustainability view and Macroeconomic perspective) and analysed in order to provide a mapping of this evolving field. Moreover, a discussion and reflection of the findings with respect to the pervasiveness of literature and the research methodologies used is provided.

Even if the work can be considered relevant for this study, it is not clear how the key terms are associated with hybrid value creation, and what are the inclusion/exclusion criteria followed by the authors. Moreover, the body of research has been categorised only considering their topical focus, while theoretical and empirical findings as well as methodological approaches have not been deeply examined.

[1] Databases provided by major publishers were used to search for related articles, such as Elsevier (www.sciencedirect.com), Emerald (www.emeraldinsight.com), Springer (www.springerlink.com), or library services (e.g., Ebsco www.ebsco.com; Scopus www.scopus.com, Metapress www.metapress.com).

Other review articles were published recently (e.g. Baines et al., 2007; Baines et al., 2009a; Meier et al., 2010; Sakao et al., 2009a). However, they are not structured as systematic reviews. Moreover, conceptual and research methodology issues are addressed only partially. Thus, a systematic review will be developed in the remainder of this chapter.

### 2.2.2 Preparation of a proposal for a review

Besides identifying the need for a review, it is necessary to "scope and map" the existing literature to determine the questions and the objectives of the systematic review. In particular:

- "literature scoping" aims to survey existing literature to determine the questions and objectives of a systematic review. It is a tool for managing the heterogeneous, and often fragmented, knowledge of research fields, considering a cross-disciplinary perspective and alternative ways in which a research topic has previously been tackled.
- "literature mapping" provides a visual map of the dominant themes in a field, their evolution and the areas of overlap with other fields.

The intent of this section is to give a brief overview of the phenomenon under investigation (*servitization*) and of its related research areas.

The term *Servitization of manufacturing* (or *Servitisation*) was first referred to in the management literature (Vandermerwe and Rada, 1988) in order to identify the generation of value by innovatively combining products (tangible component) and services (intangible component) into customer-focused "bundles". From the same semantic root comes the term *Servicisation*, that describes the increasing tendency for services to constitute the major part of the value added in many manufacturing industries (Quinn et al., 1990). The related *Servicification* (Tomiyama, 2001), and *Servicizing* (White et al., 1999) concepts focus on the enhancement of products by adding services as a strategy for dematerialization and environmental conscious design and manufacturing.

*Integrated Product and Service Offering* -IPSO- (Lindahl et al., 2006), *Integrated solution* (Wise and Baumgartner, 1999), *Customer solution* (Foote et al., 2001),

*Extended Product* (Thoben et al., 2001), *Full-Service contracts* (Stremersch et al., 2001), *Tailored-value package* (Mathieu, 2001), *Functional Product* also known as *Total care product* (Alonso-Rasgado et al,.2004), *Hybrid product* (as well as the related *Hybrid value creation* term as a synonym for *servitization*) (Berkovich et al., 2009) and *Functional sales* (Stahel, 1997; Lindahl and Ölundh, 2001) basically represent solutions compounded by combinations of products and services that satisfy an identified customer needs, with slight differences between them.

The *servitization* concept is strongly associated also with the *Product-Service System* (PSS) term, that describes new business models based on the integration of products and services, aiming to fulfil customer needs with a lower environmental impact (Mont, 2002). Unlike the previous terms, a PSS represents not only the products and the services provided to the customer, but also the system of actors involved in designing, developing and delivering the offering.

From the Marketing field, The *Service-Dominant (S-D) Logic*, primarily brought to consideration by researchers in opposition to the traditional Goods-Dominant Logic (Vargo. and Lusch, 2004), pushes forward the focus on customer needs and embraces concepts of value-in-use and co-creation of value by providing services, defined ad fundamental bases of exchange, through goods. In this context, Gummerson (1995) states that "the shift in focus to services is a shift from the means and the producer perspective to the utilisation and the customer perspective". As a consequence, the product "becomes just one element in the total, on-going service offering" (Grönroos, 2000).

In general, there is not an agreement about definitions and boundaries of these concepts, which use to change from publication to publication depending on the authors. This creates a blur literature, which hampers any attempt to get access to the whole literature referred to *servitization* or concepts related with it.

In order to draw a comprehensive picture of this field, it is then necessary to include in this systematic literature review the wide range of these different terminologies, as shown in Figure 3.

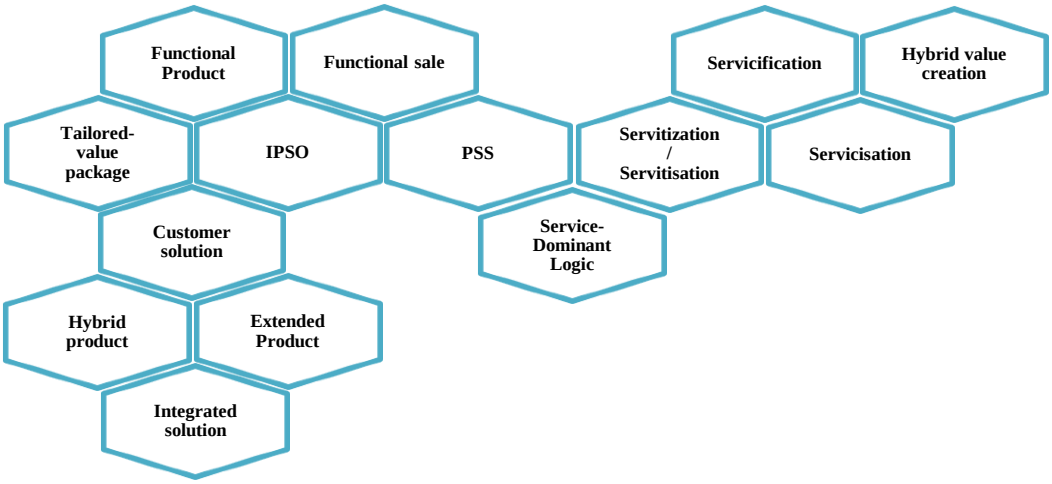



**Figure 3: Mapping the *servitization* field**

### 2.2.3 Development of a review protocol

The review question is critical to systematic review as other aspects of the process flow from it. The outcome of these decisions is captured through a formal document called "review protocol", that contains information on the specific questions addressed by the study, the focus of the study, the search strategy for identification of relevant studies, and the criteria for inclusion and exclusion of studies in the review (Davies and Crombie, 1998). Developing a review protocol is a fundamental step in a systematic literature review as it helps to protect objectivity by providing explicit descriptions of the steps to be taken (Tranfield et al., 2003).

Since it is generally considered unacceptable to plan the literature review activities closely, a more flexible approach may make explicit what the researcher intends to do *a priori*, but can be modified as the study advances. However, in case of modifications carried out throughout the review process, the researcher needs to state explicitly what changes have been made and the rationale for doing so. The aim is to produce a protocol that does not compromise the ability to be creative, whilst also ensuring reviews be less open to bias than are the more traditional narrative reviews.

The aim of this phase to define a priori the review questions and, consequently, establish a protocol to answer those questions. In particular:

I. How is the *servitization* phenomenon address in literature?
   - What are the main concepts, definitions and models developed?
   - What are the methodological approaches employed?

II. What are the research fields that refer to the *servitization* phenomenon?
   - What are the main concepts, definitions and models developed?
   - What are the methodological approaches employed?

III. How are these fields connected to the *servitization* research stream?

Before identifying the studies and the articles to be included in the database review, a framework of analysis was developed based on the systematic literature review conducted in the Supply Chain Management field by Burgess et al. (2006). It was considered adequate to develop a sound understanding of the field. Eleven dimensions were identified and grouped into four distinct categories, from descriptive features through to theoretical and methodological issues, as summarised in Table 2.

| **Grouping** | **Content covered** | **Rationale** |
|---|---|---|
| 1. Descriptive features | Time distribution of publications | Describe characteristics of sample of articles. |
| | Journal names | |
| | Authors | |
| | Origin | |
| | Industry sectors | |
| 2. Definitional issues | Approaches to definitions | Explore consistency or variation in definitions by researchers. |
| | Discipline bases | |
| 3. Theoretical concerns | Theoretical perspective | Determine the range of theories that are used and ends to which they are applied. |
| | Purpose of theory | |
| 4. Research methodological issues | Research methods | Determine the methodological assumptions being made and the types of research methods that are used. |
| | Data collection methods | |

**Table 2: The review framework**

The review framework is structured to enable a descriptive, conceptual and research methodological analysis of the field. Specifically, Group 1 describes the sample of articles used and examines main trends in the literature. Group 2 identifies what are the main definition provided in the literature. Group 3 classifies the literature around theoretical features. Finally, Group 4 examines issues associated with research methodology.

The components of the protocol are more fully explicated and discussed in the reminder of this chapter. In brief, these include: identifying and selecting studies (Phase 3 and 4), study quality assessment (Phase 5), data extraction (Phase 6) and data synthesis (Phase 7). The third Stage, finally, includes descriptive and thematic analysis (Phase 8), and discussion, limitations and conclusions (Phase 9).

## 2.3 Stage II - Conducting the review

### 2.3.1 Identification of research and selection of studies

The aim of identifying relevant studies is to get a comprehensive list of works that are able to answer the systematic review questions. As previously stated, this should be exhaustive and unbiased, which can be achieved by outlining the protocol procedures and documenting the review as it evolves. The validity of the findings directly relates to the comprehensiveness of the search used to find relevant studies.

The steps of this phase are:

i. generating a keyword list;
ii. constructing keyword search strings;
iii. choosing information sources; and
iv. developing selection criteria to determine the relevance of the studies.

#### *2.3.1.1 Generating a keyword list*

The systematic search for relevant articles began with the identification of keywords and keyword search strings (Tranfield et al., 2003). Given the different terminologies used in this field, it is difficult to create a comprehensive list of search keywords. The approach started with the most recent key papers and to backtrack through citations to identify relevant literature. Specifically, the keywords were generated mostly from the

scoping study (see Phase 2), but also cross-referencing and reading journal articles, as well as searching titles and abstracts in the academic databases previously identified using the basic search string "*servitization*".

| | | |
|---|---|---|
| Customer Solution | Hybrid Value Creation | *Servicification* |
| Extended Product | Integrated Product Service Offering | *Servicisation* |
| Full-Service Contracts | Integrated Solution | *Servitisation* |
| Functional Product | Product Service System | *Servitization* |
| Functional Sales | Service Dominant Logic | Total Care Product |
| Hybrid Product | Service Infusion | |

**Table 3: The search-keyword list**

#### *2.3.1.2 Constructing keyword search strings*

The basic search string *Servitization* was firstly used to analyse the articles explicitly addressing the *servitization* phenomenon. Additional articles were identified through the terms *Servicisation*, *Servicification*, *Service Infusion* and *Hybrid Value Creation* as synonymous of Servitization.

| **I. How is the *servitization* phenomenon address in literature?** | |
|---|---|
| Group 1 | Servitization |
| | Servitisation |
| | Servicisation |
| | Servicification |
| | Hybrid Value Creation |
| | Service infusion |

**Table 4: Group 1**

Afterwards, the remaining keywords were grouped into three main groups, as discussed in paragraph 1.2.2.

| **II. What are the research field that refer to the servitization phenomenon**? | |
|---|---|
| Group 2 | Product-Service System |
| Group 3 | Service-Dominant Logic |
| Group 4 | Integrated Product and Service Offering -IPSO- |

| | |
|---|---|
| | Integrated solution |
| | Customer solution |
| | Extended Product |
| | Full-Service contracts |
| | Tailored-value package |
| | Functional Product |
| | Total care product |
| | Hybrid product |
| | Functional sales |

**Table 5: Group 2, 3 and 4**

#### *2.3.1.3 Choosing information sources*

Multiple sources of relevant information (e.g., journal articles, books, internet, conference papers, public reports) are nowadays available. However, only published journal articles were considered in building up the literature review database. Given the strict requirements for publication of most refereed journals, excluding book chapters or unpublished work allows a better quality control (Light and Pillemer, 1984). The second choice made was to use electronic databases provided by major publishers and library services as search tools. Substantive relevance was then ensured by requiring the presence of the keyword search string in the title or the keywords or the abstract of the selected article.

#### *2.3.1.4 Developing selection criteria to determine the relevance of the studies*

A set of filters was created to identify and select substantively relevant studies and to arrive at a core set of articles for data synthesis and analysis, as follows:

i. Search for published journal articles only;
ii. Search in the databases: EBSCO, Emerald , ISI Web of Science, Metapress, Science Direct, Scopus;
iii. Ensure substantive relevance by requiring that selected articles contain at least one keyword search string in their title or abstract or keywords;
iv. Consider only English language;

v. Limit the subject area (or discipline) to Engineering, Business, Management, Accounting, Economics and Finance;
vi. Remaining abstracts read for substantive relevance;
vii. Remaining full articles read for both substantive and theoretical or empirical relevance.

Table 6 shows the number of articles returned from this methodology, with a final sample size of 335 articles. Since some articles have been found in more than one database and through more than one search keyword, the column indicating the total number does not represent the mathematical sum of the numbers in the rows.

| Keyword | **EBSCO** | **Springer Link** | **Scopus** | **Metapress** | **Science Direct** | **Emerald** | **Total** |
|---|---|---|---|---|---|---|---|
| **Group 1 - Total number of articles: 45** | | | | | | | |
| *Servitization* | 9 | 2 | 20 | 7 | 6 | 5 | **22** |
| *Servitisation* | 5 | 1 | 9 | 5 | 3 | - | **10** |
| *Servicisation* | - | - | 5 | 1 | 2 | - | **5** |
| *Servicification* | - | - | 5 | 2 | 1 | - | **5** |
| Hybrid Value Creation | - | - | 1 | 1 | - | - | **1** |
| Service infusion | - | - | 9 | - | 4 | - | **9** |
| **Group 2 - Total number of articles: 127** | | | | | | | |
| Product-Service System | 24 | 7 | 122 | 24 | 60 | 6 | **127** |
| **Group 3 - Total number of articles: 138** | | | | | | | |
| Service-Dominant Logic | 76 | 12 | 98 | 28 | 29 | 34 | **138** |
| **Group 4- Total number of articles: 45** | | | | | | | |
| Integrated Product and Service Offering | - | - | 3 | - | - | 1 | **4** |
| Integrated solution | 1 | - | 18 | 1 | 10 | 3 | **24** |
| Customer solution | 1 | - | 8 | - | 3 | - | **8** |
| Extended | - | - | - | 1 | - | - | **1** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Product | | | | | | | |
| Full-Service contracts | 1 | - | 2 | - | 1 | 1 | **2** |
| Tailored-value package | - | - | - | - | - | - | **-** |
| Functional Product | 2 | - | 3 | - | - | 1 | **3** |
| Total care product | 2 | - | 3 | - | - | - | **3** |
| Hybrid product | - | - | - | - | 1 | - | **1** |
| Functional sales | - | - | 1 | - | 1 | - | **2** |
| **Total database – 335 articles** | | | | | | | |

**Table 6: Composition of the total database**

### 2.3.2 Data extraction

The data extraction phase was designed to "accurately extract data on relevant features and results of selected studies" (NHS CRD, 2001). This was achieved through the creation of a data extraction form (Tranfield et al., 2003) that acted as a repository from which the later data synthesis emerged, depicted in Figure 4. This information was then used to tabulate the data into a descriptive and thematic analysis. The information of interests were included in the form on the basis of the framework of analysis presented in Table 2.

| | |
|---|---|
| Source (Database) | EBSCO; SCOPUS; Science Direct |

| | | | |
|---|---|---|---|
| Title | Clarifying the concept of product-service system | Keywords | Functional economy; Product-service systems; Sustainability |
| Author(s) | Mont, O.K. | Industrial sector | - |
| Year | 2002 | Discipline | General management |
| Journal | Journal of Cleaner Production | Theoretical perspective | - |
| Issue | 10 (3) | Purpose of theory | Exploratory |
| Pages | 237-245 | Research method | Conceptual |
| Document type | Journal paper | Collection method | - |
| Origin | Sweden | Comments | - |

| | |
|---|---|
| Definition | "A PSS should be defined as a system of products, services, supporting networks and infrastructure that is designed to be: competitive, satisfy customer needs and have a lower environmental impact than traditional business models" |
| Abstract | A new trend of product-service systems (PSSs) that has the potential to minimise environmental impacts of both production and consumption is emerging. This article attempts to build a theoretical framework for PSS and serves as a background for identifying possible investment needs in studying them. There are three main uncertainties regarding the applicability and feasibility of PSSs: the readiness of companies to adopt them, the readiness of consumers to accept them, and their environmental implications. The main finding is that successful PSSs will require different societal infrastructure, human structures and organisational layouts in order to function in a sustainable manner. |

**Figure 4: Data extraction form**

Two researchers, who all have practical and academic experience in the area, acted as reviewers and classified all the articles. The results were then compared and articles presenting disagreement or uncertain were then discussed by the two researchers, involving another expert. This approach were introduced to ensure a high level of inter-rate reliability.

### 2.3.3 Data synthesis

This phase includes the synthesis of the information contained the data extraction form and aims to collate and summarise the results of the included studies. This was achieved through a descriptive statistical analysis linked to the review framework, supported by the use of Microsoft Excel.

## 2.4 Stage III - Reporting the review

Reporting the review consists of the final two phases: (8) analysis; and (9) discussion, limitations and conclusions.

### 2.4.1 Analysis

For each group, the information field reported in the data extraction form were used to analyse the articles.

#### *2.4.1.1 Group 1: Servitization*

The database of this group counts for 45 articles. Among the 6 keywords identified to search for articles, the terms *Servitization* and *Servitisation* are the most used.

| **Search keyword** | **# of articles** | **% of articles** | **Articles reference numbers[2]** |
|---|---|---|---|
| Servitization | 22 | 49% | [5][19][20][21][22][23][51][105][130][135] [162][165][192][218][223][240][241][242][251] [265][304][313] |
| Servitisation | 10 | 22% | [12][135][165][228][229][240][251][254][263][ 273] |
| Service Infusion | 9 | 20% | [41][79][93][126][148][150][157][174][227] |
| Servicification | 5 | 11% | [90][130][257][260][284] |
| Servicisation | 5 | 11% | [58][60][141][263][291] |
| Hybrid Value Creation | 1 | 2% | [313] |
| Total | 45[3] | 100% | |

[2] See paragraph 2.6 for bibliographic details

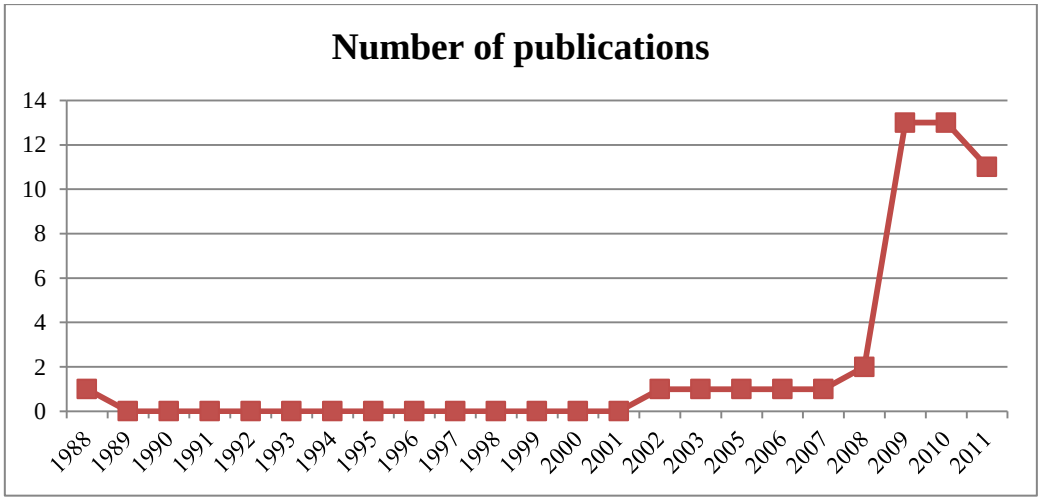
[3]The total number of reviewed articles does not correspond to the arithmetic sum since some articles were related to more than one search keyword.

**Table 7: Group 1 – Distribution of keywords**

*1. Descriptive features*

*Time distribution of publications*

The term Servitization appeared for the first time in 1988, in a paper written by Vandermerwe and Rada, entitled "Servitization of business: Adding value by adding services", and published on the European Management Journal. After a decade of silence, in the last three years (2009-2011) there has been an explosion of interest, as shown by the high number of publication (37 out of 45).




**Graph 1: Group 1 - Time distribution of publications**

*Journal titles*

The analysis shows a highly fragmented situation: 45 papers published on 34 journals, mostly referring to the Engineering and Operations Management field. So far, no special issues directly related to this topic was published. However, the editorial "Changing times and changing timescales: the servitization of manufacturing" (Wilkinson et al., 2009) of the Special Issue on "Product-service modes of working-operations management implications", published on the International Journal of Operations and Production Management (Volume 29, Issue 5, Year 2009), and edited by Adrian Wilkinson, Andy Dainty, Andy Neely, indicates that such issue has a strong relation with the servitization field: "we attempt to address this knowledge gap by assembling a range of empirical and theoretical contributions which span many sectors within which the P-S paradigm has become prevalent. In each of these papers the

challenges inherent in operationalising the P-S construct are explored, and strategies for enacting the approach are identified or constructed". [20][265]

| **Journal** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Proceedings of the Institution of Mechanical Engineers (IMechE), Part B: Journal Engineering Manufacture | 3 | 7% | [19][21][23] |
| Journal of Service Management | 3 | 7% | [126][157][174] |
| Service Industries Journal | 2 | 4% | [251][291] |
| Journal of Business Research | 2 | 4% | [93][150] |
| International Journal of Production Economics | 2 | 4% | [135][229] |
| International Journal of Operations and Production Management | 2 | 4% | [20][265] |
| International Journal of Internet Manufacturing and Services | 2 | 4% | [257][284] |
| Industrial Marketing Management | 2 | 4% | [79][241] |
| CIRP Journal of Manufacturing Science and Technology | 2 | 4% | [5][148] |
| Remaining 25 journals | 25 | 56% | |

**Table 8: Group 1 – Journal distribution of publications**

*Authors*

The analysis reveals the presence of a core set of authors, such as Tim Baines, Howard Lightfoot, John Kay, and Ashutosh Tiwari, from the Cranfield Innovative Manufacturing Research Centre, Cranfield University, UK ("IMRC is a research centre that supports UK manufacturing through the creation and dissemination of applied knowledge that moves UK manufacturing up the value chain to provide high added value manufacturing business opportunities"[4]), while Tomohiko Sakao works both at the Institute for Product Development and Machine Elements, Darmstadt University of Technology, Germany ("We have the vision of a comprehensive product development which should help to increase the welfare of society for a long time. Thereby, economic,

[4] Cranfield IMRC Annual Report (2010), available at: http://www.cranfield.ac.uk/imrc/

technical and environmental factors are tally with each other"[5]) and at the Department of Management and Engineering, Linköping University, Sweden. ("Environmentally driven development and environmental evaluation of product and services, organisations and technical systems, With a special focus on innovative proactive approaches"[6]).

| **Author** | **Affiliation** | **# of articles** | **Articles reference numbers** |
|---|---|---|---|
| Baines, Tim | Innovative Manufacturing Research Centre, Cranfield Univeristy (UK) | 5 | [19][20][21][22][23] |
| Lightfoot, Howard | Innovative Manufacturing Research Centre, Cranfield Univeristy (UK) | 5 | [19][20][21][22][23] |
| Kay, John | Innovative Manufacturing Research Centre, Cranfield Univeristy (UK) | 3 | [21][22][23] |
| Sakao, Tomohiko | Institute for Product Development and Machine Elements, Darmstadt University of Technology (Germany)<br>Department of Management and Engineering, Linköping University (Sweden) | 3 | [257][260][284] |
| Tiwari, Ashutosh | Innovative Manufacturing Research Centre, Cranfield Univeristy (UK) | 3 | [5][20][228] |

**Table 9: Group 1 – Reference authors**

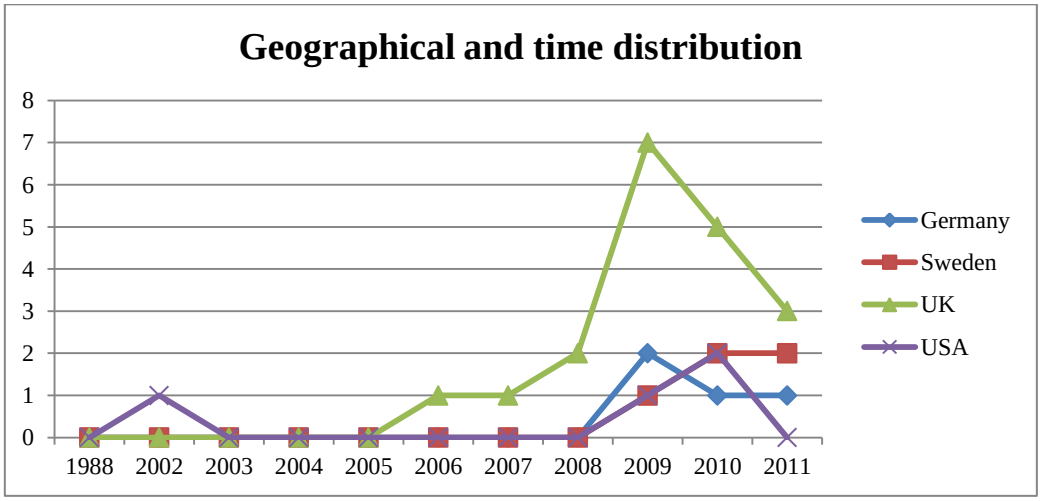
*Origin*

Geographically, the papers reviewed originate in the UK (44%), Sweden (11%), Germany (11%) and USA (9%). The remaining publications come from European countries (20%), Japan and China (both 4%).

[5] http://www.pmd.tu-darmstadt.de/pmd/index_46.en.jsp
[6] http://www.iei.liu.se/envtech/

| Origin | # of articles | % of articles | Articles reference numbers |
|---|---|---|---|
| UK | 19 | 42% | [5][12][19][20][21][22][23][60][105][135][162][165] [192][218][228][229][241][242][254] |
| Sweden | 5 | 11% | [150][148][174][223][284] |
| Germany | 5 | 11% | [79][157][257][260][313] |
| USA | 4 | 9% | [58][227][251][265] |
| Finland | 3 | 7% | [41][126][291] |
| China | 2 | 4% | [240][273] |
| Japan | 2 | 4% | [90][141] |
| Switzerland | 2 | 4% | [93][304] |
| Italy | 1 | 2% | [51] |
| Serbia | 1 | 2% | [130] |
| Spain | 1 | 2% | [263] |

**Table 10: Group 1 - Geographical distribution of publications**




**Graph 2: Group 1 - Geographical and time distribution of publications**

*Industry sectors*

Table 42 shows that almost 65% of the articles were based in the manufacturing industry sector. A closer examination showed that for the majority of articles classified as manufacturing, most dealt with a Business to Business (B2B) context (aerospace, machinery, etc.).

| Industry category | # of articles | % of articles | Articles reference numbers |
|---|---|---|---|
| Manufacturing | 29 | 64% | [20][23][21][41][58][60][79][90][93][105] [130][135][141][150][157][165][174][218] [223][228][241][242][254][257][260][263] [265][284][304] |
| Construction | 2 | 4% | [162][291] |
| Chemical | 2 | 4% | [241][251] |
| Communication | 1 | 2% | [51] |
| Health care | 1 | 2% | [5] |
| Finance | 1 | 2% | [51] |
| Power supply | 1 | 2% | [51] |
| None | 10 | 22% | [12][19][22][126][148][192][227][240][273] [313] |

**Table 11: Group 1 – Distribution of publications by sectors**

*2. Definitional issues*

*Approaches to definitions*

The different definitions, developed by the authors ore quoted from other articles, are reported in Table 12.

| **Servicisation** | |
|---|---|
| White et al., 1999 | (Servicizing) "The emergence of product-based services which blur the distinction between manufacturing and traditional service sector activities" |
| Kikuchi and Kamoshida, 2009 [141] | "Servicise means transforming manufacturers from goods supplier to service system supplier" |
| Santamarìa et al., 2011 [263] | "manufacturing firms offer services to customers" (as a synonym of servitisation) |
| **Servicification** | |
| Jergovic et al., 2011 [130] | "[…] change, by which manufacturing companies in many industries, expand Product offers with additional services" |
| Sakao et al., 2009a [260] | Servicification of consumers' behaviors means "a shift from customers' consumption of physical products to consumption of softer |

| | |
|---|---|
| | or solution-based services" |
| Sundin et al., 2009 [284] | "[…] adding more services to their customized product" |
| **Service Infusion** | |
| Kowalkowski, 2010 [148] | "Service infusion is frequently seen as a transitional path from transactional product sales to the provision of relational services and solutions" |
| Gebauer et al., 2011 [93] | "service differentiation in manufacturing firms. […] instead of services being add-ons to the product, they become the center of the total offering, with products as add-ons to the services." |
| Lay et al., 2010 [157] | "business trend, which involves increasing the relevance of services within manufacturing industries" (as a synonym of servitization) |
| **Servitization / Servitisation** | |
| Vandermerwe and Rada, 1988 [304] | Servitization is the movement in which "corporations are increasingly offering fuller market packages or 'bundles' of customer-focussed combinations of goods, services, support, self-service, and knowledge" |
| Robinson et al., 2002 [251] | "Servitization is a concept which goes beyond providing additional services but considers the total offer to the customer as an integrated bundle consisting of both the goods and the services" |
| Baines et al., 2009a [22] | "Servitization is the innovation of an organisations capabilities and processes to better create mutual value through a shift from selling product to selling PSS" |
| Johnstone et al., 2008 [136] | "general trend away from a 'pure product' orientation towards a combined 'product-service' [P-S] offering" |
| **Hybrid Value Creation** | |
| Velamuri et al., 2011 [313] | "process of generating additional value by innovatively combining products (tangible component) and services (intangible component)" |

**Table 12: Group 1 - Definitions**

Comparing the definitions, it could be argue that the different search keywords could be used as synonyms and basically they refer to the *evolutionary phenomenon from a product-centric perspective towards a product-service orientation, based on the provision of integrated bundles consisting of both physical goods and services*.

*Discipline bases*[7]

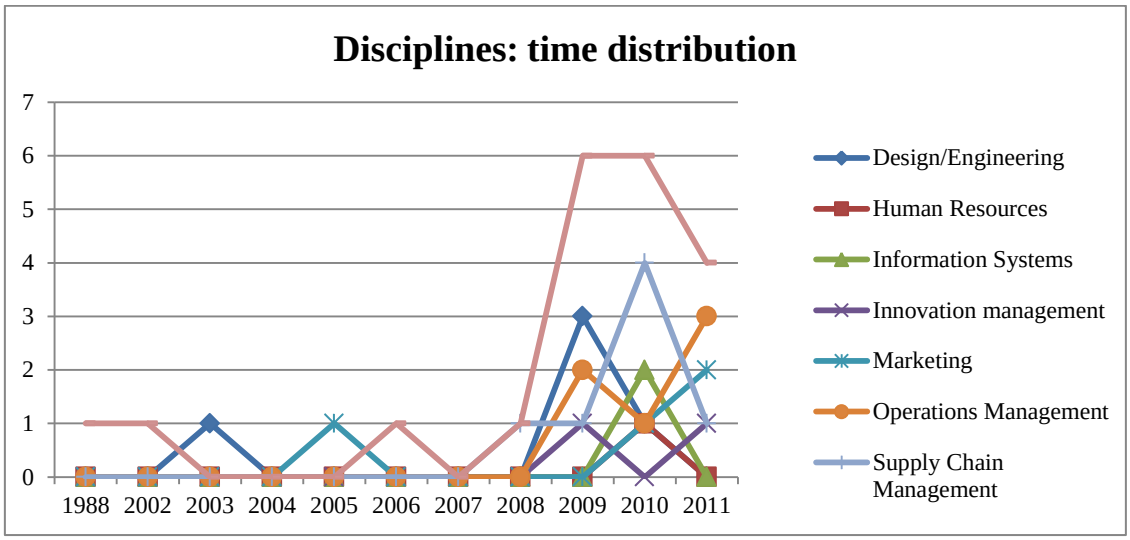
Almost half of the papers collected in Group 1 are related to General Management and Strategy, in terms of challenges, drivers and strategic trajectories of evolution. Other disciplines involved are Operations and Supply Chain Management, investigating how this new phenomenon impacts on the traditional manufacturing-related theories, and Design and Engineering for the design and development of new services.

| **Discipline** | **# of articles** | **% of articles** | **Main topics** | **Articles reference numbers** |
|---|---|---|---|---|
| Strategy / Management | 20 | 44% | Extent, motivations, challenges, typology of service strategy and growth options, role of service as a differentiation factor. | [12][23][21][60][79] [130][150][157][162] [165][174][192][218] [227][228][241][251] [254][265][304] |
| Supply Chain Management | 7 | 16% | Impact of servitization on supply chains | [58][126][135][141] [174][240][273] |
| Operations Management | 6 | 13% | Configuration of processes, capacity management | [20][105][141][223] [240][273] |
| Design / Engineering | 5 | 11% | Service conceptual design, methods for the development of new services | [51][90][257][260][284] |
| Marketing | 4 | 9% | Customer needs and customer-centricity | [41][93][148][229] |
| Information Systems | 2 | 4% | Information architecture | [5][58] |
| Innovation Management | 2 | 4% | Determinants and nature of service innovation | [263][291] |
| Human Resources | 1 | 2% | Impact of servitization on human resources and internal relationship | [242] |

**Table 13: Group 1 – Distribution by discipline**

[7] [19][22][313] are not considered in this classification since are based on a literature review. Moreover, several publications were categorised in more than one discipline.

The time-based tendency of each discipline is depicted in Graph 3.




**Graph 3: Group 1 - Time distribution of disciplines**

## *3. Theoretical concerns*

*Theoretical perspective*

A first set of papers analyse the *servitization* state of the art in different countries, for example UK (Baines et al., 2010), rather than Serbia (Jergovic et al., 2011), and in different sectors, such as microfluidic devices (Panikowska et al., 2011) or chemical (Robinson et al., 2002). The main findings are reported in Table 14.

| | **Findings** |
|---|---|
| Baines et al., 2010 [89] | "The overwhelming conclusion of this survey is that service-led competitive strategies are being adopted by many UK manufacturers and are delivering success. Manufacturers appear to be adopting a variety of service strategy offerings and some of these are quite mature. Their motivations are to grow revenues by helping to reduce costs for their customers. These tend to be emergent strategies developed via trial and error, sometimes achieved with limited organizational change, and manufacturers are experiencing success through these strategies" |
| Jergovic et al., 2011 [130] | "When we look at the overall analysis of the study, we can notice that the situation among companies operating in Serbia is satisfactory, and that top managers show a high awareness about the importance of strategic management and the changes that brings its implementation. It can be concluded that managers understand the |

| | |
|---|---|
| | strategic importance and the essence of strategic service management, as a basis for further development of their companies. Therefore, analysis of responses indicates that there is certainly room for further improvement of the business in terms of strategic service management, although it cannot be claimed that managers have an adequate model and "tools" that would allow them a structural approach for implementation of strategic service management" |
| Robinson et al., 2002 [251] | "The research, based on an empirical study of companies in the [*chemical*] sector and their supply chain relationships, suggests that service and relationship management are key strategies used by companies to escape the commodity trap and gain competitive advantage" |
| Panikowska et al., 2011 [228] | "[…]it showed that although offerings are highly based on the products, services play significant role in many organisations. The investigations conducted showed that microfluidic organisations are evolving in terms of service-thinking faster than microfluidic literature. They indicated some organisational readiness to meet new customer needs by enhancing and customising their offerings" |

**Table 14: State of the art of *servitization* in real contexts**

As seen in the Introduction, scholars agree about the benefits that a *servitization* journey entails for manufacturing firms. However, there is little empirical evidence demonstrating the positive impact of *servitization* on profitability and competitiveness, as well as investigating the factors that influence this relation. Neely (2009), for example, confirms the existence of a "service paradox" (Gebauer et al., 2005); finding that:

- larger firms, measured both in terms of numbers of employees and revenues, tend to *servitize* more than smaller firms;
- there tend to be more manufacturing firms that have *servitized* in highly developed economies than in industrialising economies
- *servitized* firms generate higher revenues, but they tend to generate lower net profits as a % of revenues than pure manufacturing firms. The reasons for this are that *servitized* firms have higher average labour costs, working capital and net assets. And they appear unable to generate high enough revenues or margins to cover the additional investment they have to make over and above the

investment made by pure manufacturing firms (this finding applies particularly to the largest firms).

Gebauer et al. (2011) further investigate the link among the complexity of customer needs, customer centricity, innovativeness, service differentiation, and business performance within the context of companies that have made a service transition from pure goods providers to service providers. In particular, they demonstrate that: i) manufacturing firms utilising service differentiation are in a better position to handle changes in customer needs than pure goods providers are; and ii) establishing customer centricity benefits from service differentiation, which is, in turn, a prerequisite for achieving higher business performance through customer centricity. However, it has to be noticed that payoff from innovativeness is higher if the firm focuses its resources on either product or service innovations. The interaction between established product innovation and emerging service initiatives is further analysed by Eggert et al. (2011), who confirm that industrial service offerings do not automatically improve company profits and that firms must align the type of services offered to their product innovation activities to effectively increase long-term profitability. The analysis is built on Mathieu's (2001) distinction between Services Supporting the Product (SSPs) and Services Supporting the Customer (SSCs). As depicted in Figure 5, when companies show low product innovation activities, both service types contribute to their long-term profits. On the contrary, when product innovation activity is high and products serve as major sources of differentiation, firms can use SSPs to support product sales and thereby enhance long-term profit. The deployment of more complex SSCs, however, requires substantial resource investments that may be difficult to obtain in a company with a history of successful product innovations.

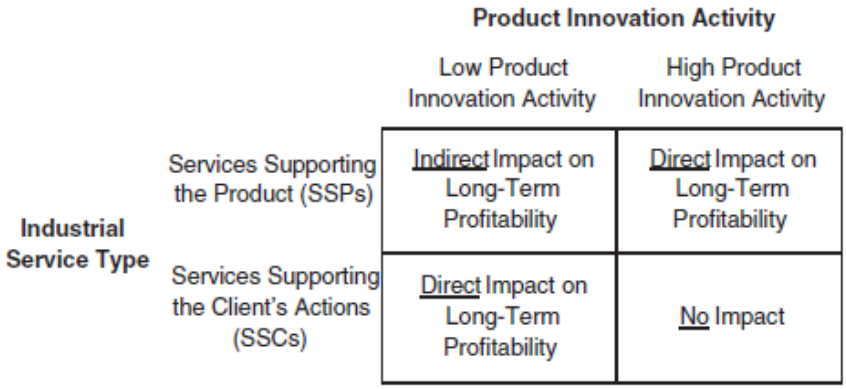



**Figure 5: Effects of industrial service types (Eggert et al., 2011)**

Lay et al. (2010) link the level of service infusion (measured in terms of service shares out of the total turnover of the firm) to the firm's level of strategic service orientation, to the type of products that are produced, and to the position of the firm in the supply chain. In particular, the results show that the most significant determinant of service sales was the breadth of services offered. The second relevant explanatory factor includes the characteristics of the type of products sold (service infusion is higher for products that are realized in small batches, or as single units that are customized and that represent technological innovations), whereas the position in the supply chain do not seem to affect service infusion. Contrasting results are provided by Löfberg et al. (2010), who demonstrate that a company's choice of service strategy appears to be influenced by the position in the supply chain. Further attributes of receptivity to Product Service Systems in UK manufacturing firms are deeply investigated by Cook et al. (2006). They are related to a range of factors in their external and internal environments, as shown in Table 15.

| External selection environment |
|---|
| *Knowledge residing in the external environment* |
| The PSS concept and its requisite knowledge set must be available in the external selection environment of firms; these must be in an accessible form; and a mobility channel must be available to enable the transfer of these from academic circles to industry. |
| *Market conditions facing the firm* |
| The PSS concept must provide a response to perceived changes in the market conditions facing a firm. These include: the need to add value and to attain greater economies of scope. |

| |
|---|
| *Legislation* |
| The PSS concept must provide a response to environmental legislation, and in particular, legislation which has been developed to engender extended producer responsibility such as the WEEE Directive. |
| Internal Environment |
| *Corporate competence* |
| Competencies for technology/knowledge transfer must exist; particularly those that are required to acquire the PSS concept and its knowledge set from a firm's external selection environment and to assimilate these into organisational structure;<br>Competencies to apply the PSS concept: those required to use the service type of transaction. |
| *Strategic orientation* |
| The PSS concept must be consistent with the firm's strategic orientation.<br>Firms must be seeking greater differentiation;<br>Firms must be seeking greater economies of scope;<br>Firms must be seeking to attain competitive advantage from compliance with environmental legislation;<br>There must be a corporate commitment to improving environmental performance. |
| *Organisational structure* |
| A structure that can facilitate the acquisition, assimilation and application of the PSS concept. |
| *Product portfolio* |
| High value products from which sufficient revenue can be secured to finance the acquisition of any additional competencies needed for service delivery;<br>Service orientated products in product portfolio;<br>Tangible products could be easily disassembled and upgraded to account for changes in technology and fashion. |

**Table 15: The attributes of receptivity to Product Service Systems in UK manufacturing firms (Cook et al., 2006)**

In their paper, Cook et al. (2006) claims that the transfer of PSS is likely to succeed in instances where firms that have already built the requisite capability to support *servitization*. However, the development of new capabilities is not the only challenge posed by this phenomenon. Summarising the contributions from Baines et al. (2009b), Brax (2005), Martinez at al. (2010), and Neely (2009), it could be argued that the challenges faced by manufacturers becoming service providers are related to:

- development of new offerings (Baines et al., 2009b; Martinez et al., 2009);

- development of a language for *servitization* (Baines et al., 2009b);
- need of vast amount of information about the installed base and of a proper communication architecture (Brax, 2005);
- alignment of the design process to product and service features (Baines et al., 2009b; Brax, 2005; Neely, 2009);
- development of an integrated delivery system (Baines et al., 2009b; Brax, 2005);
- organisational changes throughout employees, partners, and suppliers (Martinez et al., 2009; Neely, 2009);
- new role of the customer (Brax, 2005);
- shift of mind-sets and culture (Martinez et al., 2009; Neely, 2009).

It is thus evident that in order to become service providers, firms cannot merely add services on top of the original goods-dominated total offering, but a more radical approach is necessary, pervading the entire business model.

Even if these challenges are established in literature, how to overcome these challenges is still an under-investigated topic. Few models, methods, frameworks and tools have been developed to support companies in a *servitization* journey. Within the Operations Management domain, Baines et al. (2009c) propose a framework that "captures a set of operations principles, structures and processes that can guide a manufacturer in the delivery of product-centric servitized offering". The categories of operations characteristics are selected by reviewing existing classification systems for manufacture (Wheelwright, 1978; Buffa, 1984; Fine and Hax, 1984; Hayes and Wheelwright, 1984; Haas, 1987; Cohen and Lee, 1988; Mills et al., 1995; Hill, 2000) and service design frameworks (Haywood-Farmer, 1988; Silvestro et al., 1992).

| **Unit of analysis** | **Product-centric servitized operations** |
|---|---|
| *Scope* | |
| Type of company being considered | Product sold with platform of bespoke services |
| Examples of associated products and services | Lexus, Rolls-Royce (TotalCare), Toshiba Medical |
| Principal delivery system | Integrated product and service delivery system |
| Nature of the delivery system | Tends towards physical transformation of materials into tangible assets, sold along with support services, to deliver functional capability to the customer |

| | |
|---|---|
| Typical scope and capabilities of the delivery system | Design, development, production, test, monitoring, maintenance, repair refurbishment, upgrading and disposal |
| *Characteristics of value* | |
| Business model: how the company tends to do business | Tends to be based on a blend of transactional and relationship: Focusing on providing an integrated product and service offering that delivers value in use |
| Value proposition: what the customer tends to value | Tends to focus on product availability, performance, along with risk and reward sharing |
| Order winning criteria of the customer | Features of product and service Total cost of ownership Availability of product and capacity to deliver services |
| Typical value metrics for the internal delivery systems | Product life-cycle costs<br>Product conformance and service<br>System responsiveness |
| *Characteristics of operations: structural* | |
| 1. Process and technology | Tend to exploit a range of technologies, throughout operations, to achieve efficiency in production and effectiveness in service delivery |
| 2. Capacity | Tend to experience varying demand signals at multiple customer "touch points" and so need to operate with differing levels of capacity utilisation |
| 3. Facilities | Tend to combine both centralised manufacture, but mainly focusing on product final assembly and test, along with multiple field facilities for maintenance and repair located close to market |
| 4. Supply chain positioning | Tend to retain vertical integration in product manufacture and a range of closely integrated partners to deliver services |
| 5. Planning and control | Tend to focus on the optimisation of product availability |
| *Characteristics of operations: infrastructural* | |
| 6. Human resources | Tend to need workers with high levels of product knowledge and relationship development capability |
| 7. Quality control | Tend to use product assurance methods combined with customer satisfaction assessments |
| 8. Product/service range | Tend to have limited range combined with "bundles" of supporting services |
| 9. New product/service introduction | Tend to used centralised capabilities for product design, taking particular account of maintenance and repair and that complement services co-created with the customer |
| 10. Performance measurement | Tend to use product availability, response time and customer satisfaction |

| | |
|---|---|
| 11. Supplier relations | Tend to integrate internal and external supply chains into the delivery process to achieve cost effective flexibility in supply |
| 12. Customer relations | Tend to have strong interaction with customers through relationships based on product availability and performance |

**Table 16: Framework for product-centric *servitized* operations (Baines et al., 2009c)**

Olhager and Johansson (2011) explore long term capacity management decisions for integrated manufacturing and service operations. The framework is based on long-term capacity management for manufacturing operations, afterwards adapted to service operations. As shown in Figure 6, the study demonstrates that certain combinations of capacity and planning strategies are linked to either front office or back office operations. The basic choices for front office operations are lead and chase with a strong focus on effectiveness and quality. For back office operations, the baseline is lag and level with a strong focus on low-contact efficiency for the resources that the firm owns. This can be used together with a lag and chase combination for temporary capacity. Alternatively, a track and level combination would allow the firm to satisfy the average demand from the own resources.

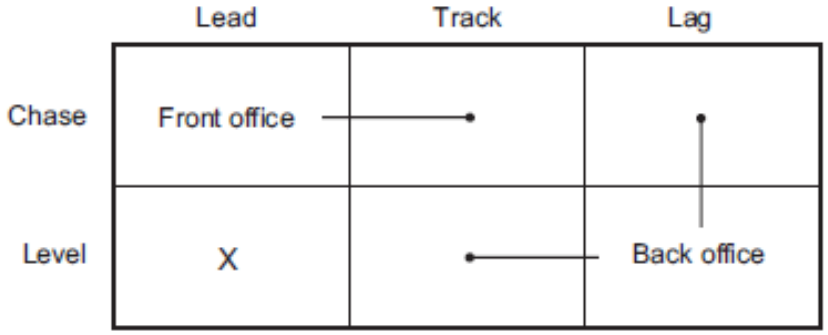



**Figure 6: Framework for combining capacity and planning strategies for front-office and back-office operations (Olhager and Johansson, 2011)**

In the Supply Chain Management area of interest, Johnson and Mena (2008) build the "Servitisation supply chain model". The model, depicted in Figure 7, emerges from the synthesis of the GSCF model (Croxton et al., 2001) and Ellram et al. (2004) service supply chain model, and comprises a range of processes that are capable of dealing with both the product and service aspects of the supply chain of a *servitised* product.

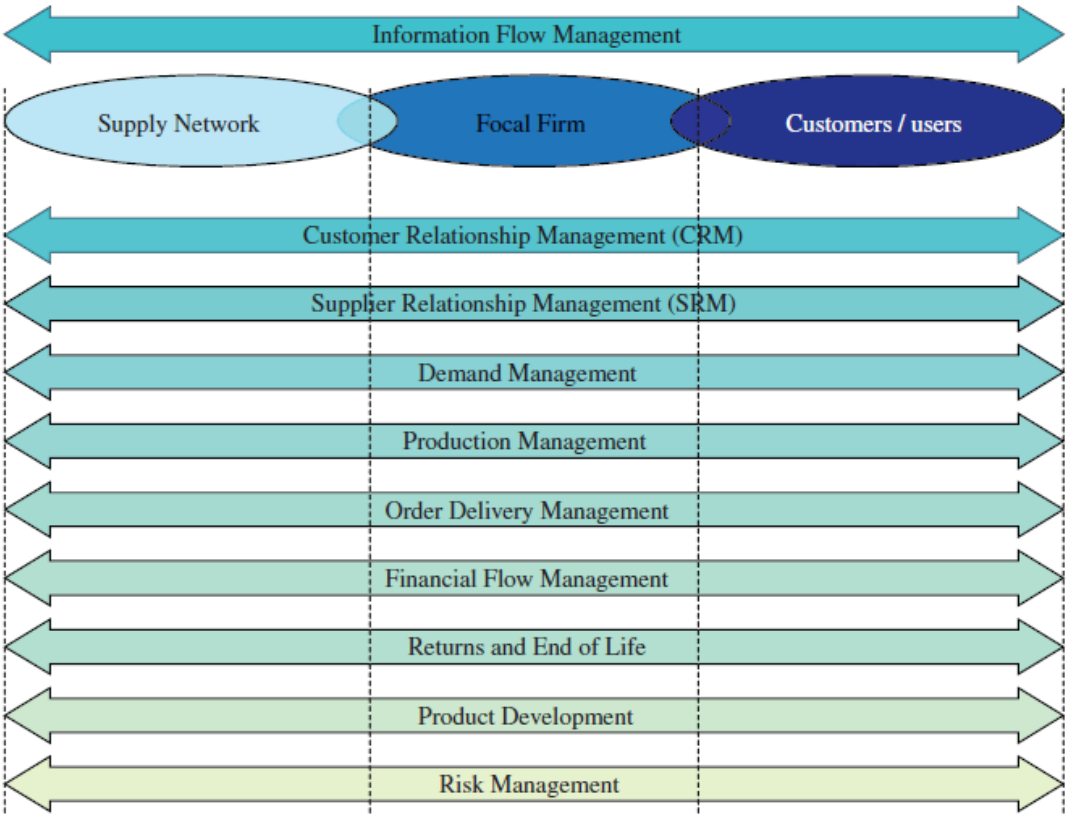



**Figure 7: *Servitisation* supply chain model (Johnson and Mena, 2008)**

In the Engineering and Design domain, a service CAD system utilised in Service/Product Engineering (SPE) and called Service Explorer, is proposed by Sakao et al. (2009b) and Sundin et al. (2009). A new type of CAD system is required to overcome the limitation of "traditional" CAD systems. It has to be able to support the design with targeting value by means of functions of products or service activities and to identify value through customer analysis. The model considers critical concepts such as value, costs, functions either of products or of service activities, and entities, and aims at helping designers with generating new ideas in the product-service design process. As reported in Table 17, the service model has been developed consisting of four sub-models: *flow model*, *scope model*, *scenario model*, and *view model*.

| **Information** | | **Modelling scheme** |
|---|---|---|
| What: | Provided value/cost | *RSP* |
| Why: | Reasons for value | *Scenario model*<br>−State transition of a service receiver<br>−Persona model of a service receiver |
| Who: | Provider and receiver | *Flow/scope model* |
| How: | Measures to provide value | *View model*<br>−Functions of physical products and service activities<br>−Physical products and service bodies as entities |

**Table 17: Information on service and modelling schemes in the service CAD system (Sakao et al., 2009b)**

The underlying concept, representing the state change of the receiver is called *Receiver State Parameter* (RSP). RSPs are classified into value and cost, depending on whether the customers like them or not. RSP change by received contents. Hence, it is assumed that contents consist of various functions, whose name is Function Name (FN), whose operating objects are Function Parameters (FP) and whose effect is represented by Function Influences (FI). Parameters expressing contents are called content parameters (CoP), while the parameters of channel are called channel parameters (ChP). Hence, both contents and channels consist of various functions, and both CoP and ChP belong to FP. The *flow model* focuses on the relationship between a receiver and a provider, while the *scope model* considers the relations between any couple of two agents that has the relation of providing/receiving value, including when they do not have a direct business contract. The *scenario model* represents receivers themselves and their behaviours in receiving the service, whereas the *view model* expresses the relationships among the elements of the service.

The relations among the four models are shown in Figure 8.

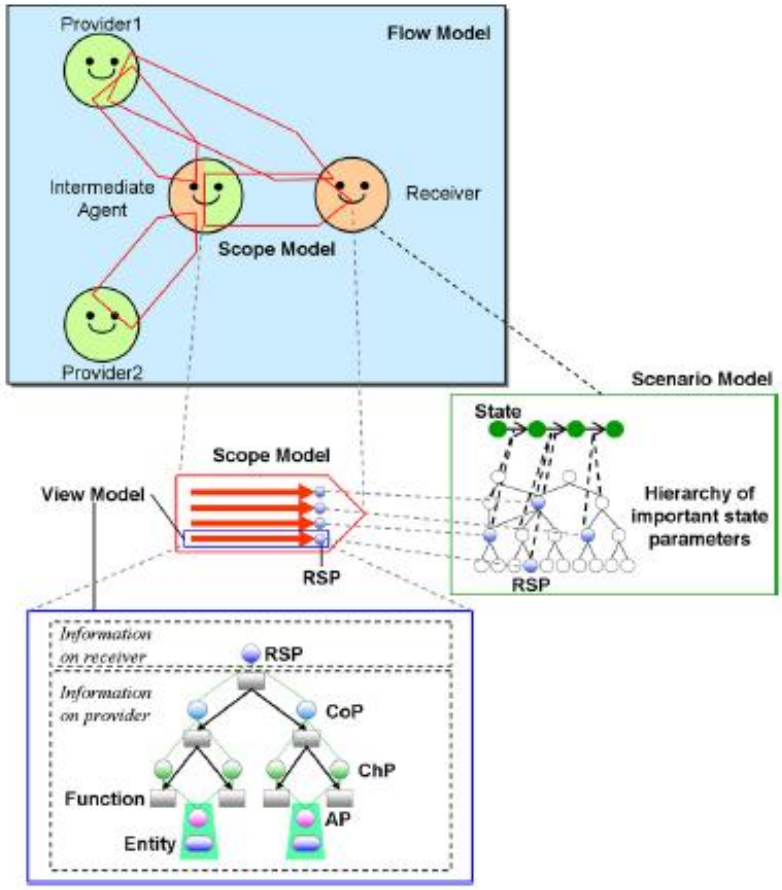



**Figure 8: The relation among the four sub-models; flow, scope, scenario, view models (Sakao et al., 2009b)**

A few papers underline the increased emphasis on customer relationship and participation required by servitization (e.g. Angelis et al., 2010; Robinson et al., 2002), as well as the acceptance of *servitization* by customers (Parry et al., 2011), without actually investigating their operational impacts on a company's business.

As argued by Raja et al. (2010), scant attention has been given to the Human Resource (HR) implications of *servitization*. In their empirical study, the authors illustrate the HR challenges associated with *servitization* and the way in which these interact with a concurrent change programme concerned with the implementation of "business partnering".

The last aspect considered is related to the determinants of service innovation in manufacturing firms (Santamaria et al., 2011). In particular, it is demonstrated that "service-related" factors (employee training activities, the use of advanced technologies

and close collaboration with customers) have positive impacts on service innovations in manufacturing firms.

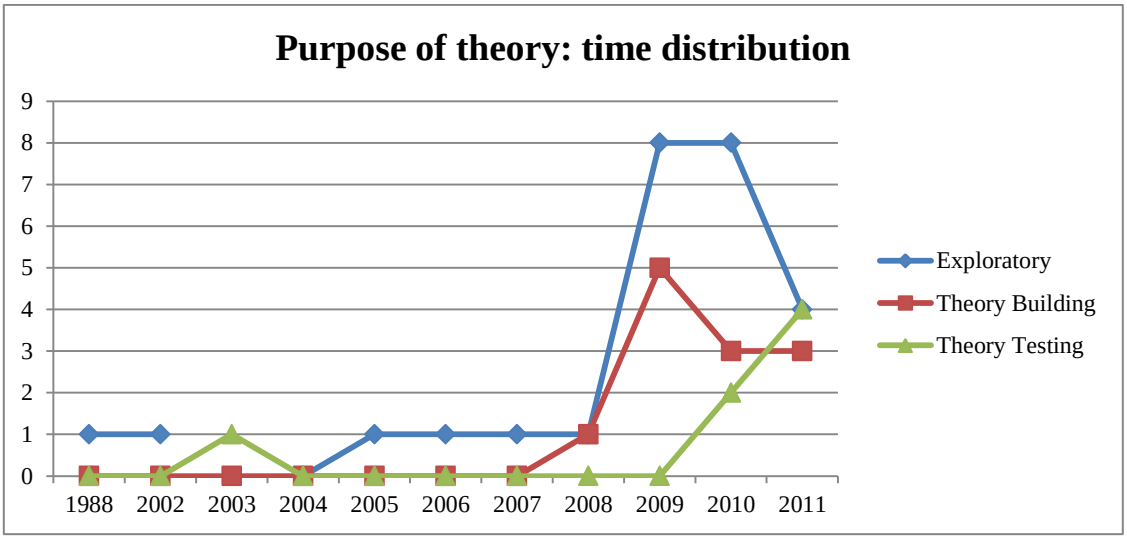
*Purpose of theory*

Further insights into the theoretical features of a field can be gained through an analysis of the purpose of theory-related activities. Handfield and Melnyk's categories (1998) were adapted and used for this purpose: i) Exploratory (Discovery and Description), ii) Theory building (Mapping and Relationship Building), iii) Theory testing (or Theory Validation), and iv) Theory Extension/Refinement. In the Exploratory group are included also papers on literature review characterised by a descriptive purpose.

| **Purpose** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Exploratory | 26 | 58% | [5][12][19][21][22][23][41][51][60][130] [141][150][148][162][165][174][192] [218][227][228][242][251][265][291] [304][313] |
| Theory building | 12 | 27% | [20][105][126][135][223][240][241][254] [257][260][273][284] |
| Theory testing | 7 | 16% | [58][79][90][93][157][229][263] |
| Theory refinement | 0 | 0% | - |

**Table 18: Group 1 - Distribution of publications in accordance with the purpose of theory**

The analysed papers mainly refer to the exploratory (58%) and the theory building (27%) phases of theory development, demonstrating that *servitization* is still an emergent topic for the scientific domain.




**Graph 4: Group 1 – Time distribution of the purpose of theory**

In particular, the exploratory publications mainly refer to the strategy and management literature ([12][23][21][60][130][150][162][165][174][192][218][227][228][251][265] [304]), and have a narrative nature, while Operations Management, Design and Engineering are more in the theory building phase, with the development of new tools and frameworks ([20][105][223][240][257] [260][273][284]).

## *4. Research methodological issues*

### *Research and data collection methods*

Epistemological insight into the field can be gained by examining the specific research methodologies that are used. Classification of such methodologies is important in order to detect potential systematic patterns in the research literature. For this research, Wacker's (1998) classification scheme was used. Wacker suggests that research methods can be broadly divided into two groups: analytical and empirical. Analytical methods are further categorized as conceptual, mathematical or statistical, while empirical methods include experimental design, statistical sampling or case studies. Results of classifying the articles according to research methods adopted are shown in Table 19.

| Method | # of articles | % of articles | Articles reference numbers |
|---|---|---|---|
| Analytical | 15 | 33% | |
| Conceptual | 13 | 29% | [5][12][19][22][126][141][148][240][254] [265] [273][304][313] |
| Mathematical modelling | 2 | 4% | [58][105] |
| | | | |
| Empirical | 30 | 67% | |
| Case based | 18 | 40% | [20][23][41][51][135][150][162][165] [174][192][223][241][242][251][257] [260][284][291] |
| Survey | 7 | 16% | [21][79][93][130][157][229][263] |
| Interviews | 2 | 4% | [60][227] |
| Secondary data analysis | 2 | 4% | [218][228] |
| Simulation model | 1 | 2% | [90] |

**Table 19: Group 1 – Methodological classification**

2/3 of the articles were classified as empirical, mostly based on exploratory case studies, aiming at discovering and describing the field. On the contrary, the survey method is more related to theory testing purposes.

#### *2.4.1.2 Group 2: Product-Service System (PSS)*

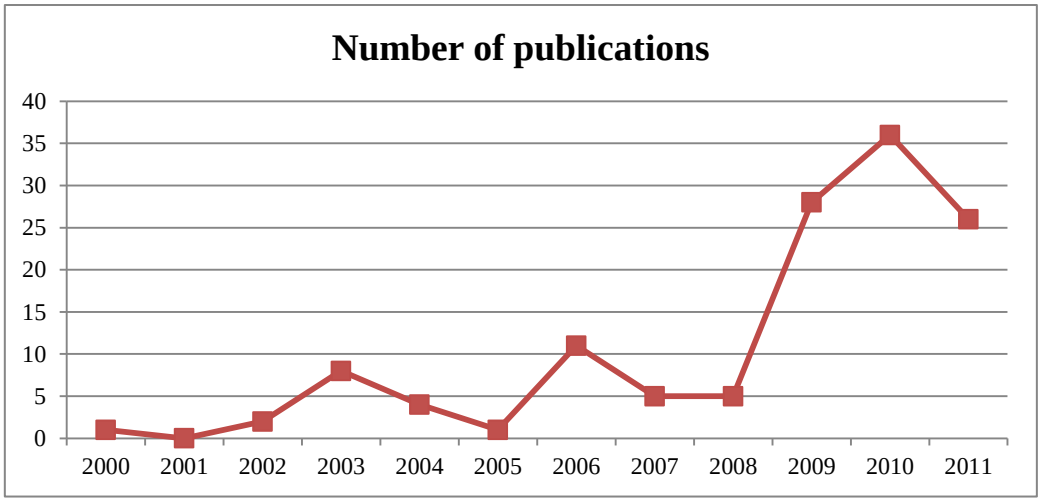
The idea of PSS originates in North Europe at the beginning of 2000s, as a new production and consumption paradigm able to reduce the environmental impact of business.

*1. Descriptive features*

*Time distribution of publications*

The first paper was published by Robin Roy in 2000. It was preceded by a publication, appeared in 1999, titled "Product Service Systems – Ecological and Economic Basics" (Goedkoop et al., 1999), commissioned by the Dutch Ministries of Environment and

Economic Affairs. Over the past 10 years, there was an exponential increase, with 71% of the articles published in the last three years (2009-2011).




**Graph 5: Group 2 - Time distribution of publications**

The PSS literature could be chronologically categorized into three groups.

At the end of 1990s (the **first stage**), the early researches on PSS mainly focused on simple cases, basically written for policy makers. There are two main projects related to this stage:

1. Product Service System

   The project, commissioned by the Dutch ministries of Environment (VROM) and Economic Affairs (EZ), had as objective the assessment of the economic and environmental relevance of Product Service Systems and their suitability in the context of the Dutch environmental policy. It started in December 1997 and continued until January 1999, aiming at exploring the subject "products and services" in relation to sustainability, economy and environment. The main output is the report "Product service systems - Ecological and economic basics" written by Goedkoop, van Halen, Te Riele, and Rommens, (1999).

2. Introducing and developing a Product-Service System (PSS) concept in Sweden

   The project, financed by the Swedish National Board for Industrial and Technical Development (NUTEK), elaborates the concept of the Product-Service System at a company level and considers existing cases and the prerequisites for shifting corporate focus towards functional thinking in order to

analyses opportunities, drivers and barriers in companies for introducing and developing innovative and marketable Product-Service Systems. The project was carried out during the period April to December 2000 by the International Institute for Industrial Environmental Economics (IIIEE) at Lund University. The report "Introducing and Developing a Product – Service System (PSS) concept in Sweden" (Mont, 2001) presents the results of the study.

During the next ten years (the **second stage**), much more researches on PSS emerged since a higher number of projects related to PSS began to be funded, mostly under the European Commission's Fifth Framework Programme (1998-2002). Some of them mainly focused on developing methods supporting industries in designing new Product-Service Systems (MEPSS, Innopse, ProSecCo), others focused also on developing new product-services or solutions (HiCS; Brainfridge), and others again tried to analyse under which circumstances product-services are likely to be accepted by consumers (Sustainable Homeservices).

1. SusProNet (http://www.suspronet.org/)

   Born as a network project, it served as a platform for experience exchange on product-service research. Five sector-oriented working groups had a central role in SusProNet (Base material, Households, Food, Offices, ICT). Their purpose was to make available best practice, to program research and to generate lessons for the best form of industry-authority interplay. All of this in narrow collaboration with partners from industry, research institutes and government. In a series of three workshops, the working groups analysed business opportunities for (sustainable) product-service systems, developed business plans and looked at issues surrounding the implementation of Product-Service Systems.

2. MePSS (http://www.mepss.nl/)

   The Product Service Systems Methodology (MEPSS) project has provided industry with a toolkit that enables them to analyse newly developed product-services with regard to: i) design and implementation aspects; ii) micro-, meso- and macro-economic impacts; and iii) social and environmental impacts and issues related to consumer acceptance and culture and ethics. The MePSS tools offer companies the means to successfully implement new product-services that

are in line with their business goals. The methodology is available via handbook (van Halen et al., 2005) and website.

3. Innopse (www.innopse.de)

   Through Innopse (Innovation studio and exemplary developments for product service engineering) was developed a methodology for service development, which was adopted from larger companies and made available to and suitable for small and medium sized enterprises.

4. ProSecCo (www.prosecco-village.com)

   ProSecCo (Product & Service Co-design) developed a toolkit to support companies with the development of product-services. This toolkit, called the 'ID ProSer (Integrated design of products and services)', consists of three modules (Opportunity Recognition; Process Implementation; Diagnosis), supported by a set of tools, methods, glossaries, contacts, links and instruments.

5. Highly Customerized Solutions (HiCS) (www.hicsproject.org)

   The main goal of the project was to provide value added solutions, instead of stand-alone products, addressing specific customers in specific contexts of use, considering their socio-cultural and physical habitats. More in particular, the HiCS project took the form of an action research project, the specific subject of which was 'food for people with reduced mobility'.

6. Brainfridge (www.solinet-research.com/brainfridge)

   The Brainfridge project aim was the production of the next generation commercial refrigerator, able to automatically registers which packaged food and beverages are placed inside, using RFID tags. Also, the refrigerator has a functional mobile communications unit for uninterrupted communication with the food/beverage suppliers. This allows for several new product-services, such as: i) automatic billing/invoicing of the customer, ii) automatic ordering and re-ordering procedures; iii) food safety guarantee.

7. Sustainable Homeservices (www.sustainable-homeservices.com)

   The project evaluated 200 sustainable household services from six European countries with a tool consisting of environmental, social and economic

indicators. The findings and the Service Sustainability Evaluation Tool are available on the website and on a DVD film.

The second stage ended with the SCORE (Sustainable Consumption Research Exchanges) project, supported by the Sixth Framework programme. SCORE started in 2005 and was essentially a network project emphasising user awareness for sustainable consumption. Many of SusProNet's results fed into SCORE.

In recent years (the **third stage**), some researchers, involved in the collaborative research project Transregio 29 "Industrial Product-Service Systems – Dynamic Interdependency of Product and Service in Production Area", (http://www.lps.rub.de/tr29/) put forward the concept of iPSSs (industrial PSSs), providing a new turning point from academic research to industrial applications. In particular, the main aim of the project, funded by the German Research Foundation (DFG), is to develop a new theory on PSS which enables a better understanding of such systems and which helps to plan, develop and operate (deliver and use) these more effectively. Approaches, process descriptions, methods and tools are generated to support the PSS engineering and the PSS theory. The effects of the paradigm shift towards more lifecycle oriented business models are being researched in 12 part projects. These are split up in the fields "A – Planning/Development", "B – Delivery/Usage" and "C – Lifecycle". Finally, the Cranfield University (UK) has promoted a three year project (2009-2011), called Product-Service Systems (http://www.cranfield.ac.uk/imrc/research/pss/index.html), to investigate the managerial impact of adopting these new product-service based business models and to explore the suitability of a *servitization* strategy. The main project is structured into five sub-projects: i) Capability Based PSS Conceptual Design; ii) Networks for Product-Service Systems; iii) Operations strategies to deliver product-service systems; iv) Transformations To Servitized Organizational Forms; and v) Assessing the value created by PSS.

*Journal titles*

There are four referential journals for this area: i) Journal of Cleaner Production (17% - 2010 Impact Factor: 2,430); ii) CIRP Journal of Manufacturing Science and Technology (9%); iii) International Journal of Advanced Manufacturing Technology (9% - 2010

Impact Factor: 1,071); and Journal of Manufacturing Technology Management (9%). The titles of the journals highlight two key characteristics of the PSS landscape: sustainability and manufacturing field.

Five special issues directly addressing the PSS concept were published:

- Journal of Cleaner Production (Volume 11, Issue 8, Year 2003), Special Issue on "Product Service System" (editor: Oksana Mont): "provide an interesting and varied selection of experiences and perspectives of the progress in the area of PSS and sustainable consumption" (Mont, 2003). [125][189][195][210][279]
- Journal of Cleaner Production (Volume 14, Issue 17, Year 2006), Special Issue on "Product-Service Systems: reviewing achievements and refining the research agenda" (editors: Oksana Mont and Arnold Tukker): "shows the progress that has been made in the PSS field in the last decade, including various national and international research projects and companies' initiatives, important achievements and gaps at theoretical and practical levels" (Mont and Tukker, 2006). [14][43][60][152][196][211][214][288]
- Journal of Engineering Design (Volume 20, Issue 4, Year 2009), Special Issue on "Product-service systems" (editors: Rajkumar Roy and David Baxter): "presents state of the art in PSS development and design" (Roy and Baxter, 2009). [194]
- International Journal of Advanced Manufacturing Technology (Volume 52, Issue 9-12, Year 2010), Special Issue on "Product-service systems" (editors: Rajkumar Roy, Essam Shehab and Ashutosh Tiwari): "presents ten selected papers that cover state of the art research in a number of PSS areas" (Shehab and Roy, 2010). [67][74][81][128][155][161][199] [205][335]
- International Journal of Internet Manufacturing and Services (Volume 2, Issue 1, Year 2009), Special Issue on "Product Service Solutions in Life-Cycle Activities" (editors: Pingyu Jiang and Tim McAloone): "focuses on reporting current research progresses and industrial case studies related to product service solution in the whole product life-cycle activities" (Jiang and McAloone, 2009). [131][254][257][284][290]

Moreover, as for Group 1, the Special Issue on "Product-service modes of working-operations management implications", published on the International Journal of Operations and Production Management (Volume 29, Issue 5, Year 2009), and edited by Adrian Wilkinson, Andy Dainty, Andy Neely, is related also to the PSS field. [233][276]

Finally, a forthcoming issue on Computers in Industry is scheduled, "Product-Service System Engineering: From Theory to Industrial Applications", edited by Sergio Cavalieri, Giuditta Pezzotta and Yoshiki Shimomura.

| **Journal** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Journal of Cleaner Production | 22 | 17% | [14][35][43][60][98][125][137] [152][163][189][195][196][207] [210][211][214][256][279][288] [314][321][322] |
| CIRP Journal of Manufacturing Science and Technology | 12 | 9% | [5][15][75][118][148][198][245 ][250][268][285] [287][320] |
| International Journal of Advanced Manufacturing Technology | 11 | 9% | [67][74][81][128][155][156] [161][199][205][281][335] |
| Journal of Manufacturing Technology Management | 11 | 9% | [16][17][102][143][173][192] [215][246][248] [259][283] |
| Remaining 45 journals | 71 | 56% | |

**Table 20: Group 2 – Journal distribution of publications**

*Authors*

The analysis reveals the presence of a core set of authors belonging to technical and engineering departments. Rajkumar Roy, Ashutosh Tiwari, Jeffrey R. Alcock, and Steve Evans are from the School of Applied Science, Cranfield University, UK ("Research in the School of Applied Sciences' focuses on environmental science and technology, manufacturing, and materials"[8]). Oksana Mont is from the International Institute for Industrial Environmental Economics, Lund University, Sweden ("Research at the IIIEE focuses on policy, strategies, and management for advancing sustainable solutions by governments, businesses and other relevant societal stakeholders. Specific focus is on

[8] http://www.cranfield.ac.uk/sas/

understanding the power of business and social innovation in addressing the sustainability challenges"[9]), while Tomohiko Sakao works both at the Institute for Product Development and Machine Elements, Darmstadt University of Technology, Germany ("We have the vision of a comprehensive product development which should help to increase the welfare of society for a long time. Thereby, economic, technical and environmental factors are tally with each other"[10]) and at the Department of Management and Engineering, Linköping University, Sweden. ("Environmentally driven development and environmental evaluation of product and services, organisations and technical systems, With a special focus on innovative proactive approaches"[11]). Finally, George Q. Huang, from the Department of Industrial and Manufacturing Systems Engineering, University of Hong Kong, Hong Kong ("The Department has also attempted to enhance its research strength by focusing its current research mainly on the modeling, simulation, control, and management of complex industrial systems, such as logistics and supply chain systems, and manufacturing systems"[12]), and Yoshiki Shimomura, from the Department of System Design, Tokyo Metropolitan University, Japan ("The faculty of system design covers the following areas: human mechatronics systems, information and communications systems, aerospace engineering, management systems engineering, and industrial art"[13]).

[9] http://www.iiiee.lu.se/research/
[10] http://www.pmd.tu-darmstadt.de/pmd/index_46.en.jsp
[11] http://www.iei.liu.se/envtech/
[12] http://www0.hku.hk/imse/
[13] http://www.sd.tmu.ac.jp/en/

| Author | Affiliation | # of articles | Articles reference numbers |
|---|---|---|---|
| Roy, Rajkumar | School of Applied Science, Cranfield University (UK) | 8 | [17][19][33][63][72][81] [197][254] |
| Mont, O.K. | International Institute for Industrial Environmental Economics, Lund University (Sweden) | 7 | [68][207][208][209][210] [211][212] |
| Sakao, Tomohiko | Institute for Product Development and Machine Elements, Darmstadt University of Technology (Germany)<br>Department of Management and Engineering, Linköping University (Sweden) | 7 | [118][256][257][259][260] [284][285] |
| Alcock, Jeffrey | School of Applied Science, Cranfield University (UK) | 6 | [5][72][73][74][75][205] |
| Evans, Steve | School of Applied Science, Cranfield University (UK) | 6 | [19][36][82][173][192][287 ] |
| Tiwari, Ashutosh | School of Applied Science, Cranfield University (UK) | 6 | [5][17][72][74][75] |
| Huang, George | Department of Industrial and Manufacturing Systems Engineering, University of Hong Kong (Hong Kong) | 5 | [127][128][201][240][335] |
| Shimomura, Yoshiki | Department of System Design, Tokyo Metropolitan University (Japan) | 5 | [118][143][256][260][284] |

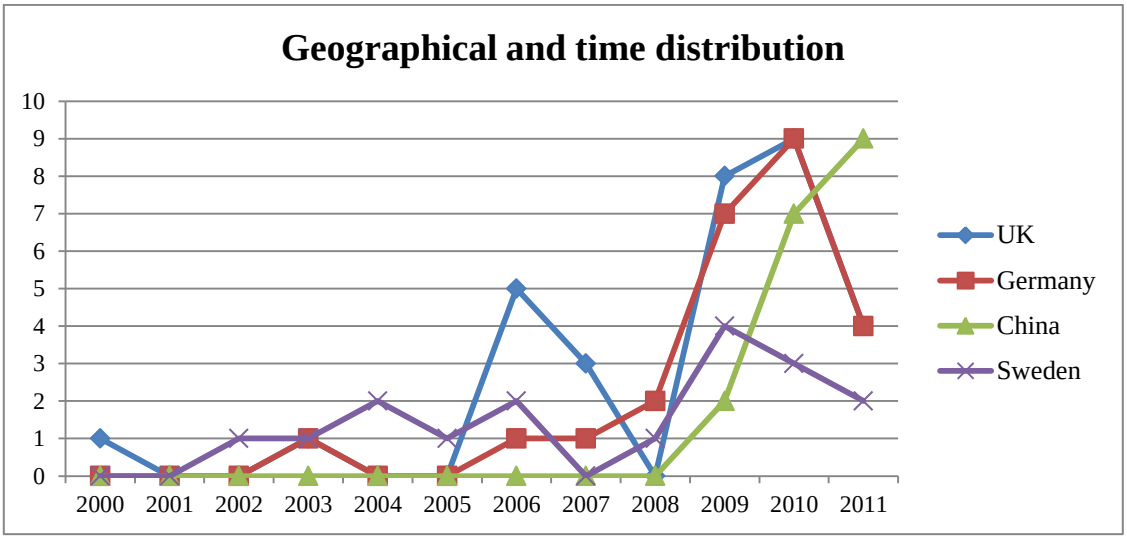
**Table 21: Group 2 – Reference authors**

*Origin*

Geographically, the papers reviewed originate mostly in the UK (31%), Germany (25%), China (14%) and Sweden (13%). All the papers from China were published in the last three years (2009-2011), symptom of a budding interest in the topic, as shown in Graph 6.

| Origin | # of articles | % of articles | Articles reference numbers |
|---|---|---|---|
| UK | 31 | 24% | [5][17][19][33][43][60][67][72][73][74][75][81][82] [102][103][173][192][196][218][222][233][252] [253][254][255][276][277][320][321][322][329] |
| Germany | 25 | 20% | [2][3][4][14][15][16][34][83][125][197][198][199] [205][245][246][250][256][257][260][266][267] [268][290][289][313] |
| China | 18 | 14% | [92][94][95][96][127][128][131][132][155][156] [204] [240][281][316][332][333][334][335] |
| Sweden | 17 | 13% | [35][68][134][148][175][207][208][209][210][211] [212][221][248][259][283][284][285] |
| Italy | 5 | 4% | [36][53][189][247][294] |
| Denmark | 4 | 3% | [213][214][215][287] |
| Korea | 4 | 3% | [98][99][100][331] |
| Finland | 3 | 2% | [13][117][122] |
| Japan | 3 | 2% | [118][143][288] |
| The Netherlands | 3 | 2% | [146][298][314] |
| USA | 3 | 2% | [142][161][279] |
| France | 2 | 2% | [163][194] |
| India | 2 | 2% | [63][269] |
| Taiwan | 2 | 2% | [169][275] |
| Unknown | 1 | 1% | [201] |
| Austria | 1 | 1% | [137] |
| Brazil | 1 | 1% | [152] |
| Ireland | 1 | 1% | [195] |
| Singapore | 1 | 1% | [160] |

**Table 22: Group 2 - Geographical distribution of publications**




**Graph 6: Group 2 - Geographical and time distribution of publications**

*Industry sectors*

Table 42 shows that more than half of the articles were based in the manufacturing industry sector. A closer examination showed that the articles classified as manufacturing refer both to Business to Business (B2B) contexts (aerospace, machinery, electrical equipment, etc.) and to Business to Consumer (B2C) applications (household appliances, automotive, etc.).

| **Industry category** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Manufacturing | 62 | 49% | [4][14][16][17][33][35][53][60][68][74][75] [83][92][94][95][96][100][102][103][117][125] [128][131][132][134][148][155][160][161] [189][194][195][196][201][208][209][211] [218][221][233][245][247][254][257][260] [266][267][269][275][277][283][284][285] [287][288][290][314][316][321][322][331] [333] |
| Chemical | 5 | 4% | [13][189][212][222][279] |
| Communication | 1 | 1% | [67] |
| Health care | 4 | 3% | [5][196][205][294] |
| Others | 9 | 7% | [43][63][72][82][143][163][213][255][256] |
| None | 48 | 36% | [2][3][15][19][34][36][73][81][98][99][118] [122][127][137][142][146][152][156][169] |

| | | | |
|---|---|---|---|
| | | | [173][175][192][197][198][199][204][207] [210][214][215][240][246][248][250][252] [253][259][268][276][281][289][298][313] [320][329][332][334][335] |
| Total | 127[14] | | |

**Table 23: Group 2 – Distribution of publications by sectors**

*2. Definitional issues*

*Approaches to definitions*

The different definitions, developed by the authors ore quoted from other articles, are reported in Table 24.

| **Product-Service System (PSS)** | |
|---|---|
| Goedkoop et al., 1999 | "A Product Service system (PS system) is a marketable set of products and services capable of jointly fulfilling a user's need" |
| Mont, 2002 [207] | "A system of products, services, supporting networks and infrastructure that is designed to be: competitive, satisfy customer needs and have a lower environmental impact than traditional business models" |
| UNEP, 2002 | "the result of an innovative strategy that shifts the centre of business from the design and sale of (physical) products alone, to the offer of product and service systems that are together able to satisfy a particular demand" |
| Manzini and Vezzoli, 2003 [189] | "An innovation strategy, shifting the business focus from designing (and selling) physical products only, to designing (and selling) a system of products and services which are jointly capable of fulfilling specific client demands" |
| Baines et al., 2007 [19] | "PSS is an integrated product and service offering that delivers value in use" |
| Qu et al., 2011 [240] | "Product service system (PSS) is an innovative business mode where a product and its associated services are combined together in a certain proportion and provided to customers in a reasonable way, by selling or renting or even mixing" |

**Table 24: Group 2 - Definitions**

[14] The total number of reviewed articles does not correspond to the arithmetic sum since some articles refer to more than one sector.

The first generally accepted definition of PSS was given in 2002 by Mont. Since then, most contributors have broadly adapted this definition, considering a PSS as *sustainable business model, characterised by an integrated product-service offering*.

Recent interests in PSS have extended to industrial sectors. Meier et al. (2010) put forward the concept of IPSS (also referred as $IPS^2$): "An Industrial Product-Service System is characterized by the integrated and mutually determined planning, development, provision and use of product and service shares including its immanent software components in Business-to-Business applications and represents a knowledge-intensive socio-technical system. This means in detail: i) an IPS2 is an integrated product and service offering that delivers values in industrial applications; ii) IPS2 is a new product understanding consisting of integrated product and service shares; iii) IPS2 comprises the integrated and mutually determined planning, development, provision and use; iv) IPS2 includes the dynamic adoption of changing customer demands and provider abilities; v) the partial substitution of product and service shares over the lifecycle is possible; vi) this integrated understanding leads to new, customer-adjusted solutions; vii) IPS2 enable innovative function-, availability- or result-oriented business models". Aurich et al. (2006) introduced a specific case of PSS, which focuses on provision of services for a product core that has a high net value and involves transactions in a B2B context. It is named technical Product-Service System (t-PSS), where "the term 'technical' emphasizes the followings: i) the investment character of both physical and nonphysical PSS components; ii) the relatively higher monetary value and importance of the physical PSS core; and iii) the business-to-business relation between PSS manufacturers and customers.". The industrial product-service system for CNC machine tool is called mt-IPSS, and is defined as a "systematic package in which intangible technical services are attached to a tangible machine tool as well as its attachments to finish various machining activities in the whole product life cycle" (Zhu et al., 2010). Finally, within the chemical sector, Chemical Management System (CMS) is defined as a "Product Service System with significant potential environmental benefits. CMS is a business model in which a customer engages with a service provider in a strategic, long-term contract to supply and manage the customer's chemicals and related services." (Stoughton and Votta, 2003).

*Discipline bases*

The papers collected in Group 2 are not exclusively possessed by a specific discipline[15]. They are rather a focal point for several disciplinary research fields, each investigating landscapes from different perspective.

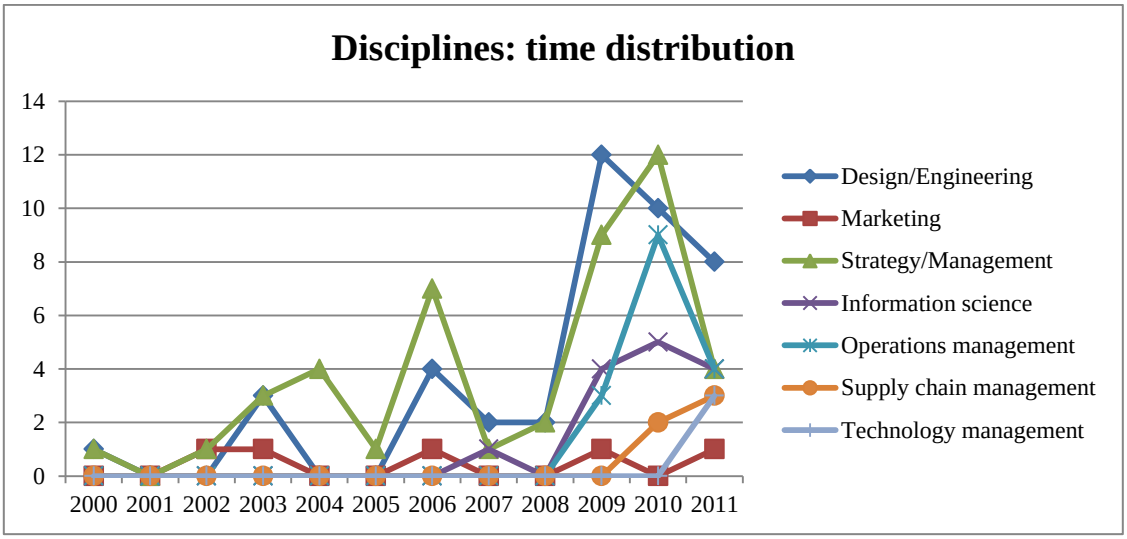
| **Discipline** | **# of articles** | **% of articles** | **Main topics** | **Articles reference numbers** |
|---|---|---|---|---|
| Strategy / Management | 45 | 35% | Barriers and opportunities for the implementation of the PSS concept, business model elements, classifications and types of offerings, strategic implications and changes, management accounting. | [13][15][16][17][35][36] [43][60][68][75][83][92] [103][117][122][132][148] [156][169][192][197][199] [201][205][207][208][209] [211][212][218][222][233] [245][253][254][255][267] [269][275][279][288][294] [298][321][322] |
| Design / Engineering | 42 | 33% | Methods, frameworks and tools for PSS design and development. | [14][15][33][34][82][94] [95][96][98][118][142] [143][146][152][161][163] [175][189][194][195][196] [197][204][213][214][215] [221][246][248][250][253] [256][257][260][283][284] [287][289][316][329][331] [332] |
| Operations Management | 16 | 13% | Process and capacity management, impacts at the shop-floor level. | [4][63][67][81][128][131] [155][240][247][268][276] [281][285][333][334] [335] |
| Information System | 14 | 11% | Methodologies and tools for information and knowledge management. | [2][3][5][33][34][72][73] [74][102][134][160][198] [266][290] |
| Marketing | 5 | 4% | Customer satisfaction | [94][125][143][152][314] |

[15][19][259][313][320] are not considered in this classification since are based on a literature review. Moreover, several publications were categorised in more than one discipline.

| | | | | |
|---|---|---|---|---|
| | | | and acceptance evaluation. | |
| Supply Chain Management | 3 | 2% | Network | [173][252][277] |
| Technology Management | 3 | 2% | Supporting technology | [99][100][127] |
| Others | 4 | 3% | Policies | [53][137][210] |

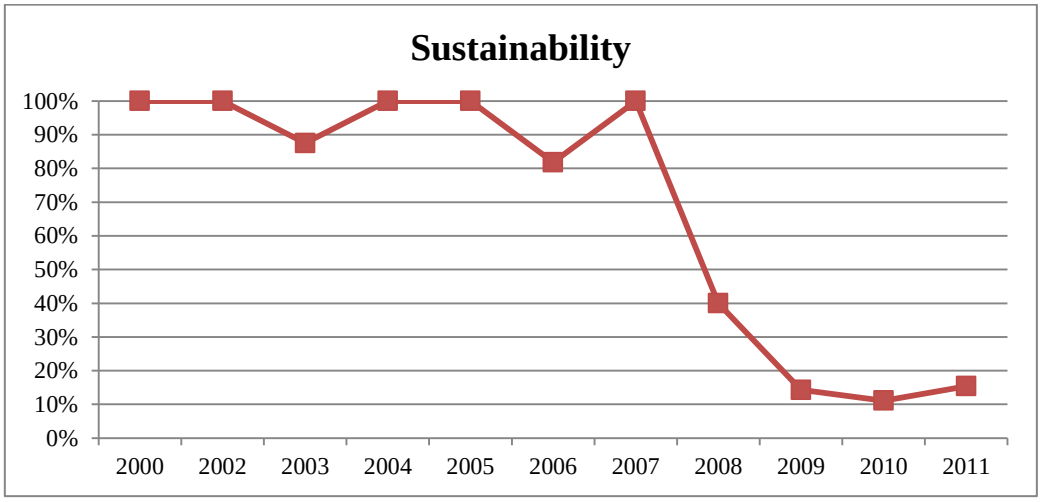
**Table 25: Group 2 – Distribution by discipline**

The design and delivery of PSSs are addressed by various research disciplines, each of which applies its own point of view. A business perspective tends to view PSS from a strategic perspective (mostly represented). Main themes of interest encompass the investigation of barriers and enablers for implementing a PSS, its structural elements and its key performance indicators. Considering the design and engineering disciplines, efforts are directed to develop methods, frameworks and tools for the design of PSSs. In particular, a novel discipline is emerging: the Service Engineering. Its aim is "to increase the value of artefacts and to decrease the load on the environment by reason of focusing service. […]. SE aims at intensifying, improving, and automating this whole framework of service creation, service delivery, and service consumption." (Sakao and Shimomura, 2007). The popular discipline of Operations Management emphasises the impacts at a shop-floor level, and on process and capacity management. The discipline of Information Systems stresses the need for developing methodologies and tools for managing information flows and capturing knowledge, aided by IT support. Customer satisfaction and acceptance of product-service solutions are topics investigated by the Marketing discipline, while a few paper examine the network dimension of a PSS business model (Supply Chain Management) and the required technological innovation (Technology Management). Graph 7 shows the time-based trend.




**Graph 7: Group 2 – Time distribution of disciplines**

Apart from these disciplines, PSSs from a sustainable standpoint are seen as a means to create solutions with lower environmental impact, since they may allow for resources to be used more efficiently. Even if the general field of PSS grew out of a history of sustainability research, during the last years the attention towards such aspect has significantly dropped, as shown in Graph 8.




**Graph 8: % of papers including sustainability issues (per year)**

## *3. Theoretical concerns*

### *Theoretical perspective*

Several papers show how the PSS concept is applied or can be implemented in different sectors, such as health care (Adeogun et al., 2010; Mittermeyer et al., 2010), chemical

(Anttonen, 2010; Mont et al., 2006b; Oldham and Votta, 2003; Stoughton and Votta, 2003), office furniture (Besch, 2005), coffee production (Devisscher and Mont, 2008), microsystem technologies (Durugbo et al., 2011b), mold and die products (Huang et al., 2010), baby prams (Mont et al., 2006a), tooling (Schuh et al., 2011; Zhu et al., 2010), and automotive (Williams 2006; 2007).

Another set of papers analyses the factors and the drivers that influence, either enabling or hindering, a successful PSS implementation. In particular Bianchi et al. (2009) build a system dynamic model that incorporate several PSS factors able to influence the success of a PSS, while Besch (2004) identified the following barriers for the implementation of the PSS concept in the European office furniture market:

- financial risk for the service provider;
- market conditions;
- no legislative pressure for and no interest in environmental improvements;
- characteristics of office furniture;
- resistance to change;
- importance of fashion and design.

Also Kuo et al. (2009) focus their attention on the identification of PSS implementation barriers, divided into four categories (Table 26) and structured into seven levels (Figure 9).

| **Aspect** | **Barriers** |
|---|---|
| External | Lack of support from relevant laws and regulations<br>Lack of market acceptance |
| Internal | Lack of strategic planning<br>Rejection of change by internal personnel<br>Lack of an ideal management information system<br>Lack of training and education<br>Lack of technical personnel and support<br>Lack of support from senior management<br>Lack of awareness related to PSS |
| Maintenance | Load increase in maintenance service system<br>Difficulty in managing components for maintenance service |
| Remanufacturing | Different recycling time and quantity as well as product quality<br>Difficulty controlling and managing materials<br>Lack of reverse logistics |

**Table 26: Identified barriers for PSS implementation (Kuo et al., 2009)**

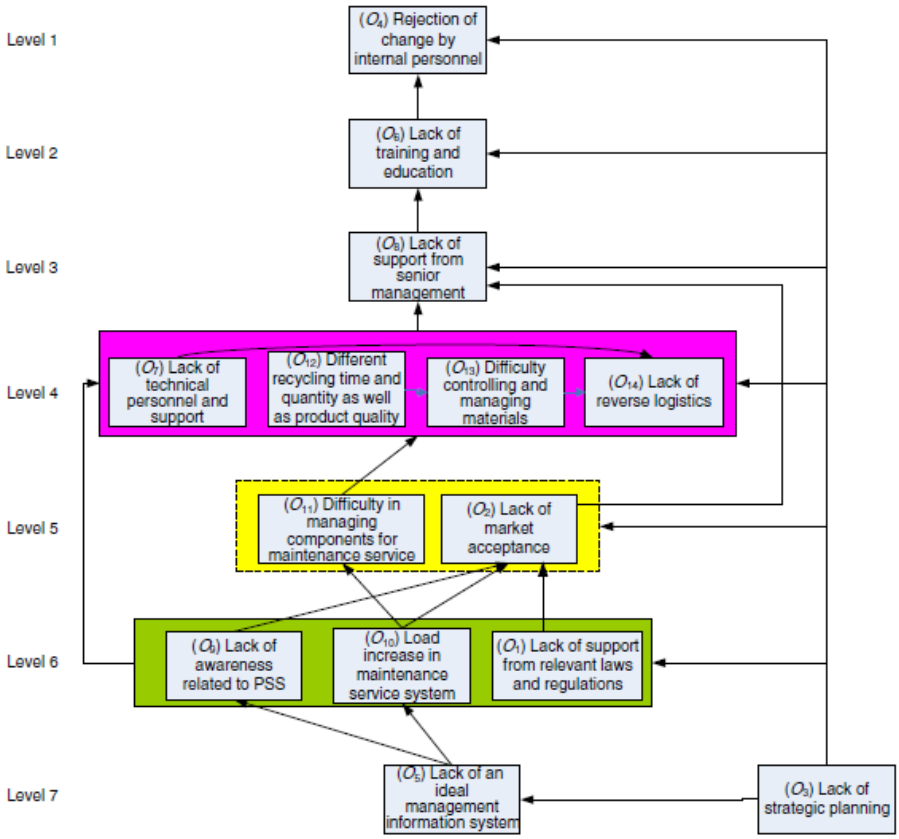



**Figure 9: Multilevel structure hierarchy of the barriers (Kuo et al., 2009)**

Moreover, Mont et al. (2006b) discuss advantages and barriers for both PSS providers and customers in the chemical sector, while Rese et al. (2009) stress the importance of customer preference drivers for identifying the right IPS$^2$ to implement. In particular an IPS$^2$ compass (Figure 10) is proposed as a means of orientation for suppliers: the direction of the arrow under the preference driver shows the expected choice towards make/buy and manual/automatic process execution in case of a high value of the preference driver. The compass in the middle of the figure shows the meaning of the direction.

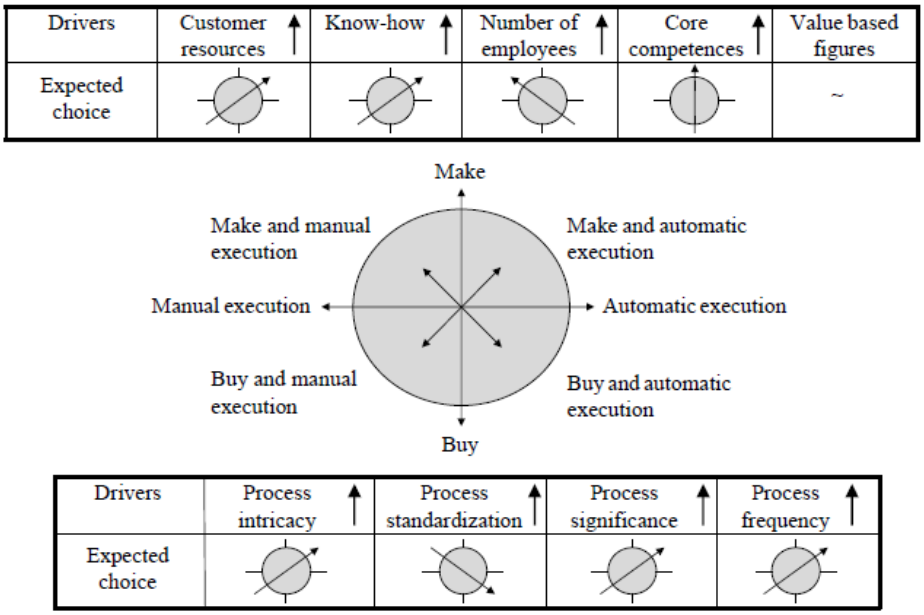



**Figure 10: The IPS$^2$ compass (Rese et al., 2009)**

Other authors focus their attention on investigating specific factors. For example, the role of the public policy factor in promoting the diffusion of PSSs is analysed in Ceschin and Vezzoli (2010) and Mont and Lindhqvist (2003). Furthermore, the promotion of the PSS concept as a program for sustainable consumption and production is highlighted in Briceno and Stagl (2006) and Kang and Wimmer (2008).

Finally, the papers from Cook et al. (2006) and Martinez et al. (2010), discussing respectively attribute of receptivity and challenges, have already been mentioned in Group 1.

What is a PSS and what are its constituting elements are fundamental topics discussed firstly by Mont (2002) and further refined by Mont (2004b), as graphically represented in Figure 11.

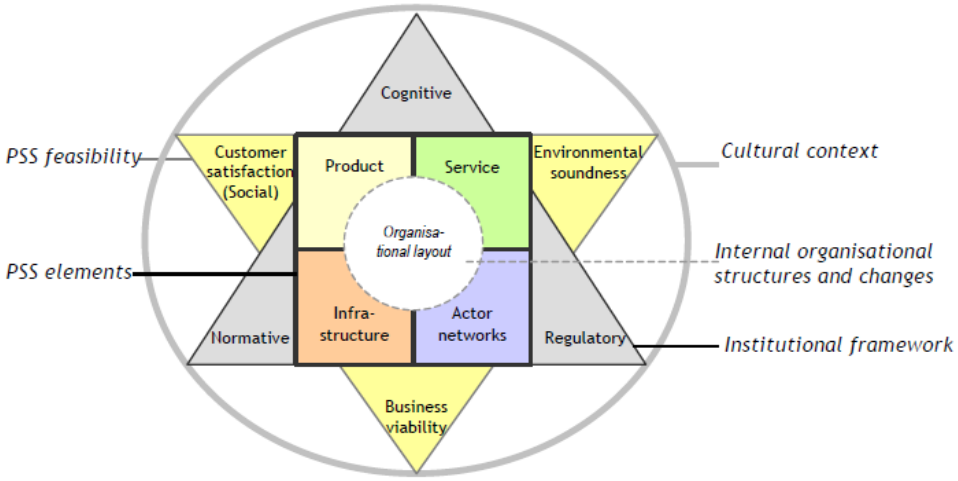



**Figure 11: PSS framework (Mont, 2004b)**

The framework provides a systematic perspective on the evaluation and development of PSSs, by taking into account also the specific background of each system through institutional factors and cultural context.

A more articulated description of IPS$^2$ and its architectural elements is provided by Meier et al. (2010a;b) and is based on the business model concept, as represented in Figure 12.

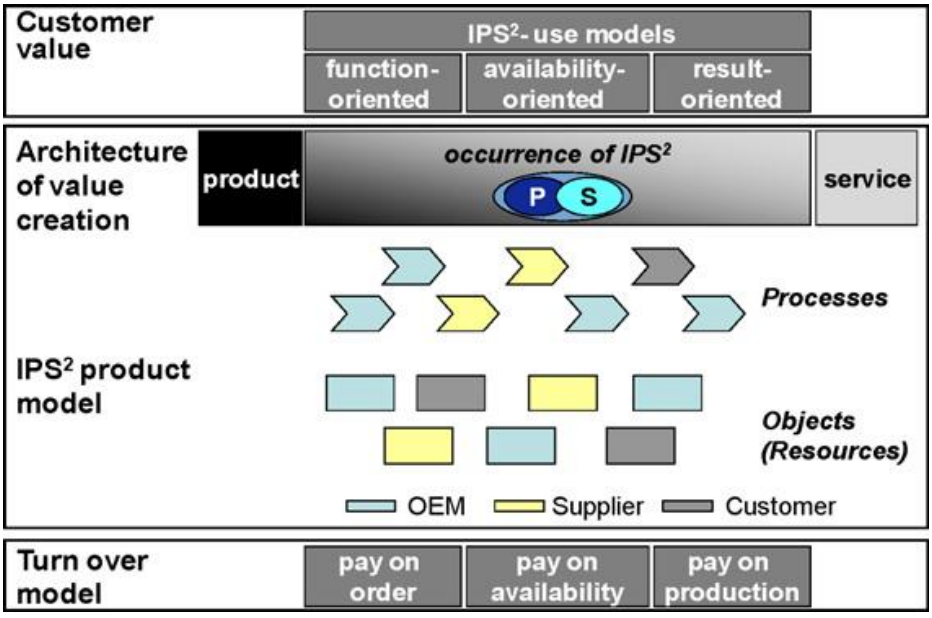



**Figure 12: Business models for IPS$^2$ (Meier e al., 2010a;b)**

The infrastructure element is studied from an IT point of view by Lee et al. (2007), who propose an IT infrastructure and architecture based on semantic web services to support

a product service network, and by Schuh et al. (2011), who propose a web-based collaboration platform approach as an effective method of sharing information and coordinating activities among the partners involved in the network. The impacts of the PSS provision on a company and its network are described in Pawar et al. (2009), where the PSO (Product Service Organisation) framework is introduced to highlight the organisational challenges of PSS (Figure 13), and in Lockett et al. (2011), where supply chain relationships in business networks that design, manufacture and support PSS are investigated. In particular, two strong themes emerged from the case studies: the need for incentive alignment and of an effective information sharing.

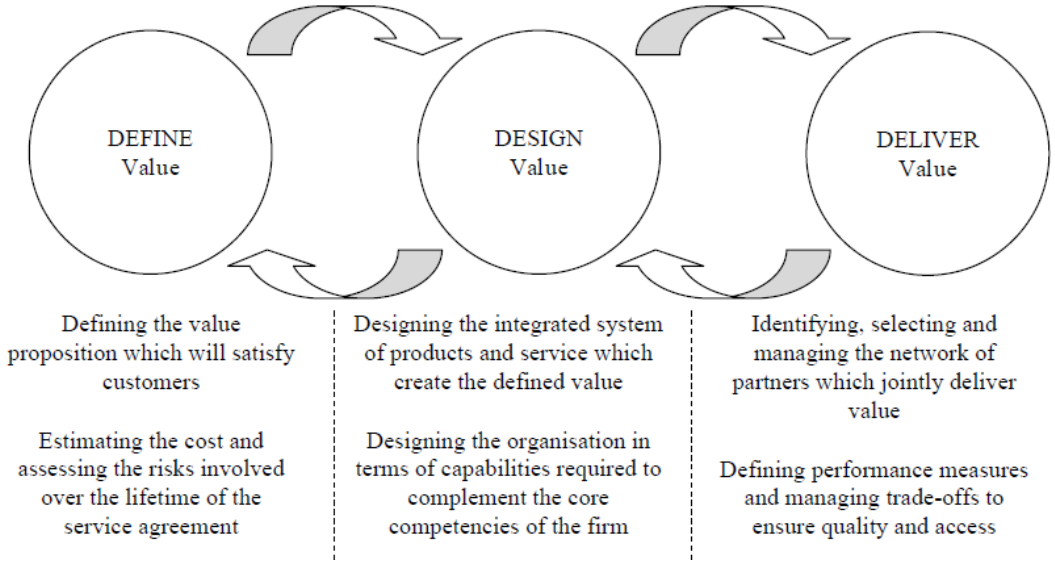



**Figure 13: The PSO framework (Pawar et al., 2009)**

As previously discussed, how to design and develop a PSS is one of the main topic investigated by scholars. For example, Morelli (2003; 2006; 2009) proposes tools and methods, commonly used in other disciplines, with the aim of testing them in the PSS domain and generating a methodology for the design process of a PSS, composed by three main phases:

- analysis and interpretation of the context;
- development of the system;
- representation and communication techniques that facilitate interaction in the service encounter.

The theoretical discussion was then applied to a research project named TeleCentra, undertaken in Melbourne (Australia), aimed at defining the design process for a support service for nomadic workers and telecommuters.

Maxwell et al. (2006) and Maxwell and van der Vorst (2003) introduce the Sustainable Product and/or Service Development (SPSD) approach. It provides a framework process (Figure 14) for designing sustainable offerings (be it a product, a service, or a PSS) along their life cycle, considering also the associated supply chain.

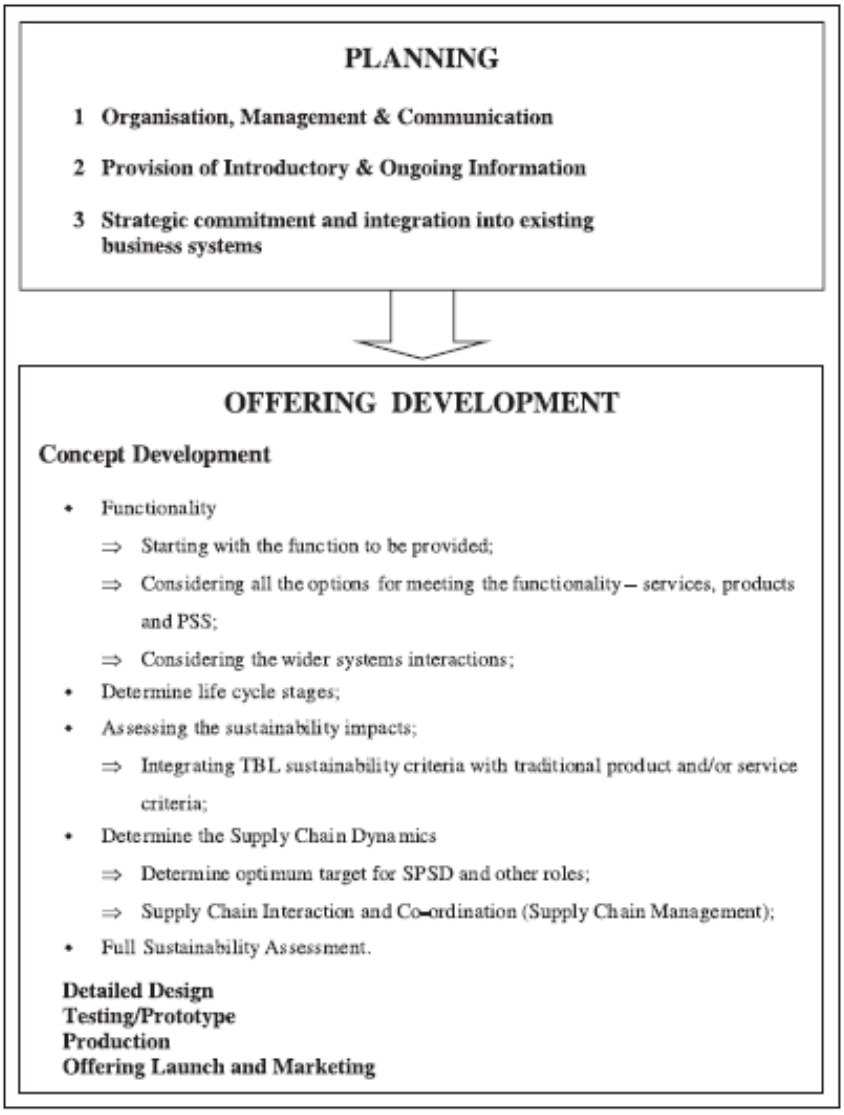



**Figure 14: SPSD implementation process stages (Maxwell et al., 2006)**

Also Manzini and Vezzoli (2003) consider the PSS sustainability potential, thus introducing the concept of "strategic design for sustainability", defined as a design activity aiming at an integrated system of products, services and communication, which

are jointly capable of fulfilling specific client demands, while re-orienting current unsustainable trends in production and consumption practices. It is based on a satisfaction/solution wide-system based optimization (Figure 15), and on the capability to create new stakeholder configurations, characterised by convergent interests.

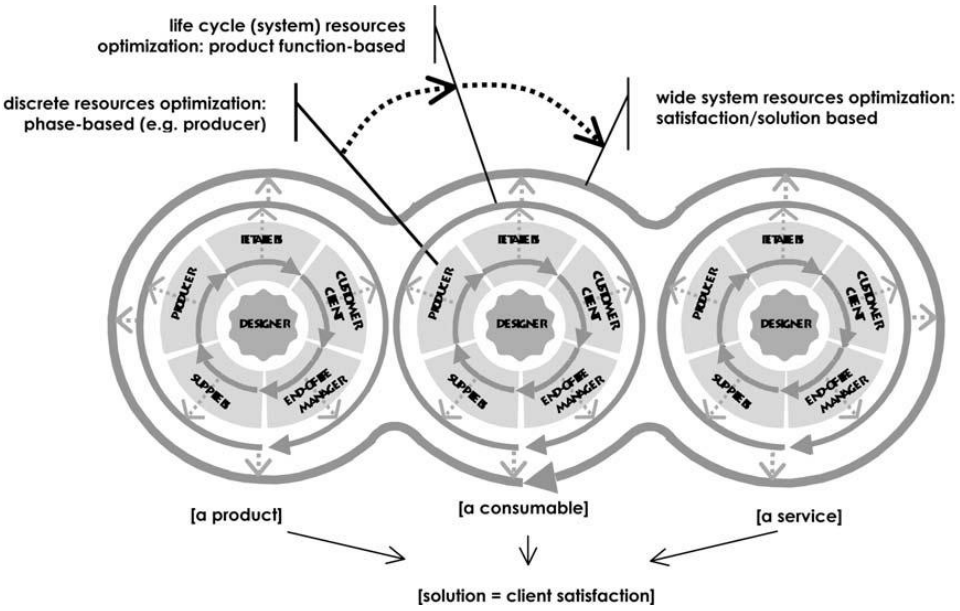



**Figure 15: Stakeholders in a products and services life cycle mix: discrete > life cycle > satisfaction-system resources optimization (Manzini and Vezzoli, 2003)**

In Geng et al. (2010; 2011) and Geng and Chu (2012) a systematic decision-making approach for the optimal PSS planning is proposed. It is carried out through four phases (Figure 16):

1. determining the initial importance weights of Engineering Characteristics (ECs) considering Customer Requirements (CRs) based on fuzzy pairwise comparison;
2. obtaining the final importance weights of ECs considering customer requirements as well as requirements of the manufacturers based on Data Envelopment Analysis DEA;
3. categorizing ECs into different Kano attribute classes based on fuzzy Kano's questionnaire (FKQ) and fuzzy Kano's mode (FKM);
4. identifying the optimal fulfilment levels of ECs based on optimisation using non-linear programming.

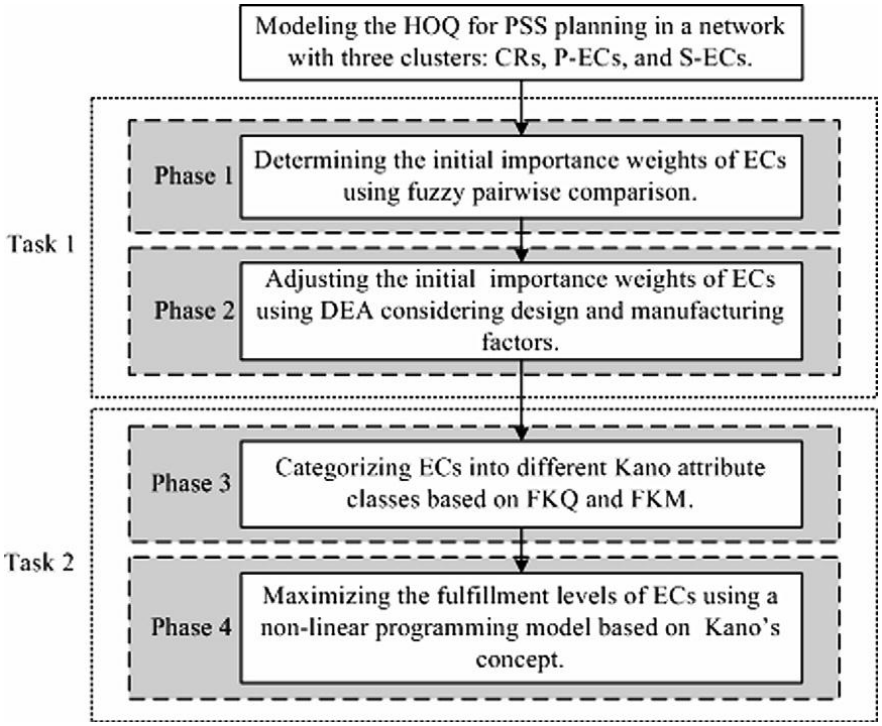



**Figure 16: The framework of the systematic decision-making approach for the optimal PSS planning (Geng et al., 2011)**

Moreover, several authors (for example Sakao et al., 2009) rely on the Service Engineering (SE) approach, that tries to adapt traditional engineering approaches to service design, as already discussed in Group 1. In particular Aurich et al. (2010) present a review of the main SE models, methods and tools found in literature, emphasising at the same time the need to consider a life cycle perspective (also highlighted in Aurich et al., 2006), while Komoto and Tomiyama (2008) and Hara et al. (2009) introduce a design modelling method and a tool to integrate product and services for total customer value, implemented using a CAD system (called Service Explorer). Service Explorer is capable of both reviewing and designing a new service, can help visualize services, can evaluate services and can simulate services.

Similarly, the effect of introducing PSS on the product design is discussed by Sundin et al. (2009a) and Maussang et al. (2009).

Another important topic is related to knowledge and information management to support PSS design, development and delivery (Baxter et al., 2009; Abramovici and Linder, 2011; Durugbo et al., 2010; Durugbo et al., 2011a; Goh and McMahon, 2009). Since through services a company can have access to product operational information that can be used to improve the development and the quality of following product

generation, a proper knowledge and information management system to capture and manage products and customer data need to be designed.

Finally, economic and/or environmental assessment of PSSs are presented in Azarenko et al. (2009), Erkoyuncu et al. (2010), Firnkorn and Müller (2011), Gottberg et al. (2010), Halme et al. (2004), Heiskanen and Jalas (2003), Mont (2004a), Rese et al. (2009), Tasaki et al. (2006), and Vogtländer et al. (2002).

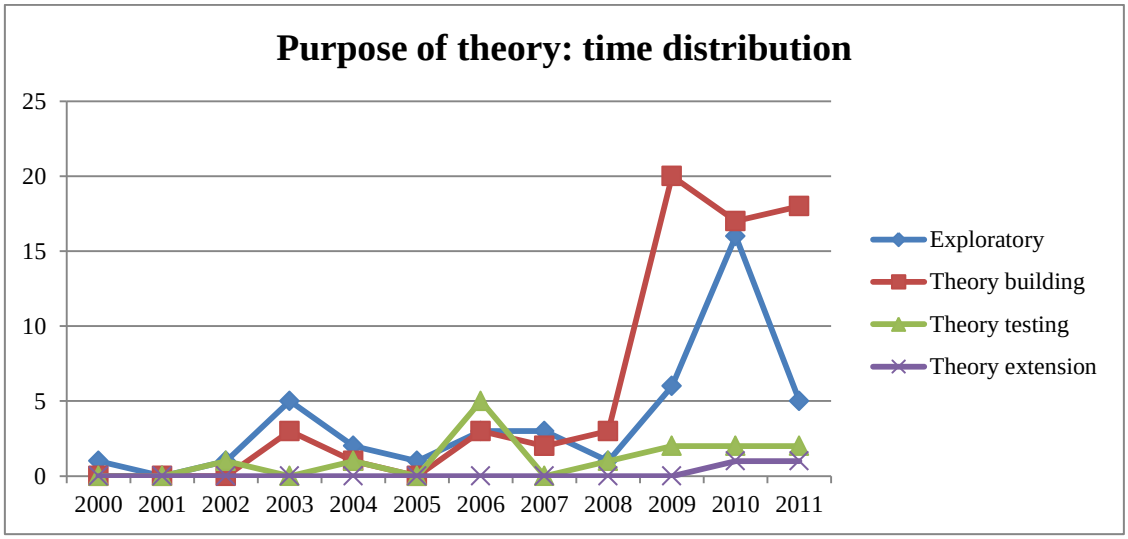
*Purpose of theory*

The 127 publications mainly refer to the theory building (53%) phase, demonstrating that the scientific domain of PSS is in a growing stage.

| **Purpose** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Exploratory | 44 | 35% | [2][5][15][19][34][35][53][60][75][81][82][92] [103][117][122][125][132][137][148][169][173] [192][197][201][207][210][212][218][221][222] [248][250][253][259][268][276][277][279][287] [298][313][320][321][322] |
| Theory building | 67 | 53% | [3][4][13][14][16][17][33][36][63][67][72][73][94] [95][96][98][99][100][102][118][127][128][131] [134][142][143][146][152][156][160][161][175] [189][195][198][199][204][208][213][214][215] [233][240][245][246][247][252][254][256][257] [260][266][267][269][281][284][285][289][290] [294][316][329][331][332][333][334][335] |
| Theory testing | 14 | 11% | [43][68][74][83][155][194][196][209][211][255] [275][283][288][314] |
| Theory refinement | 2 | 2% | [163][205] |
| Total | 127 | 100% | |

**Table 27: Group 2 - Distribution of publications in accordance with the purpose of theory**

Temporally, theory building has gained importance in the last three years (2009-2011), while for the exploratory publications there is a pick in 2010, mainly related to Management and Strategy disciplines.




**Graph 9: Group 2 – Time distribution of the purpose of theory**

In particular, the publications categorised in the exploratory group are mostly related to the strategy and management field ([15][35][60][75][92][103][117][122][132] [148][169][192][197][201][207][212][218][279][298][321][322]), while the design and engineering discipline are more in the theory building phase, due to the development of frameworks, models and methods for PSS design ([14][33][94][95][96][98][118] [142][143][146][152][161][175][189][195][204][213][214][215][246][256][257][260] [256][284][289][316][329][331][332]).

*4. Research methodological issues*

*Research and data collection methods*

Results of classifying the articles according to research methods adopted are shown in Table 28.

| **Method** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| *Analytical* | *80* | *63%* | |
| Conceptual | 74 | 58% | [2][3][4][5][14][15][16][19][34][53][67][72] [73][74][81][92][94][95][96][98][99][100] [117][118][122][127][128][131][132][137] [142][146][148][152][160][161][163][169] [195][197][198][199][201][204][207][208] [210][212][214][215][221][222][240][246] |

| | | | |
|---|---|---|---|
| | | | [247][250][252][253][254][259][266][267] [268][269][276][288][289][298][313][320] [321][322][329][332] |
| Mathematical modelling | 3 | 2% | [281][334][335] |
| Simulation | 3 | 2% | [36][155][175] |
| | | | |
| *Empirical* | *47* | *37%* | |
| Case based | 28 | 22% | [17][33][63][68][82][102][125][173][189] [192][194][196][205][211][213][233][245] [256][257][260][277][279][283][284][285] [287][290][316] |
| Survey | 5 | 4% | [43][83][143][255][275] |
| Interviews and workshops | 6 | 5% | [35][60][103][134][156][248] |
| Secondary data analysis | 4 | 3% | [13][75][218][331] |
| Action research | 2 | 2% | [209][294] |
| Experiment | 1 | 1% | [314] |
| Mathematical model | 1 | 1% | [333] |
| Total | 127 | | |

**Table 28: Group 2 – Methodological classification**

62% of the articles were classified as analytical, mostly based on conceptual studies, highlighting the need of an in-depth and rigorous empirical research in order to develop models, methods, and theories based on real-life examples and applications.

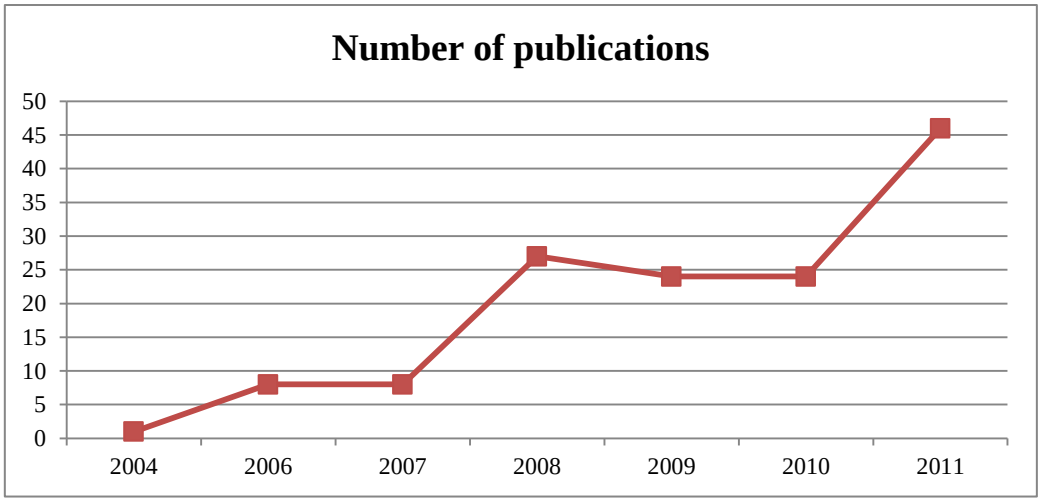
#### *2.4.1.3 Group 3: Service Dominant Logic (SDL)*

*1. Descriptive features*

*Time distribution of publications*

The term Service Dominant Logic (SDL) appeared for the first time in 2004, "Evolving to a new dominant logic for marketing" (Vargo and Lusch, 2004), published in the

Journal of Marketing. Then, the number of publications related to this topic has increased almost exponentially.




**Graph 10: Group 3 - Time distribution of publications**

*Journal titles*

The analysis shows that the journals with the higher number of publications on SDL mostly refers to the Marketing domain, with the Journal of the Academy of Marketing Science (2010 Impact Factor: 3,269) counting for 14 papers (10%).

In 2006 the special issue "On the service-dominant logic of marketing: insights from The Otago Forum", edited by Robert Aitken, David Ballantyne, Phil Osborne, and John Williams, was published on Marketing Theory (Volume 6, Issue 3): "The summative overview, four invited commentaries and six papers in this special issue are provided by a number of participants in the Otago Forum and reflect the major topics of conversation and the international flavour of the discussions that took place. They range in conceptual contributions from a call to re-conceptualise our notions of markets to a plea to more usefully privilege consumption experiences. More importantly, these contributions reflect a synthesis of the major developments within marketing theory that not only tell the story of S-D logic so far, but also suggest why it is now time to assimilate them into a more holistic and integrative conception of marketing." (Aitken et al., 2006).[45][85][106][178][264]

The second special issue on SDL ("Service-Dominant Logic: Continuing the Dialog") appeared in 2008, on the Journal of the Academy of Marketing Science (Volume 36, Issue 1), edited by Robert F. Lusch and Stephen L. Vargo: "The purpose of this

commentary is to explore the major issues surrounding S-D logic and to offer revisions to the FPs as published in the 2004 JM article." (Vargo and Lusch, 2008). [1][26][71][113][186][187][202][234][308][309][327]

Finally, in 2011 was published on Industrial Marketing Management (Volume 40, Issue 2) a third special issue on "Service-Dominant Logic in Business Markets", edited by David Ballantyne, Rob Aitken and John Williams: "application of the service-dominant logic paradigm to the industrial marketing arena." (Ballantyne et al., 2011). [27][86][87][108][185][239][311]

Moreover, two forthcoming issues are scheduled:

- "Towards a Better Understanding of the Role of Value in Markets and Marketing", Review of Marketing Research, editors: Stephen L. Vargo and Robert F. Lusch;
- "Applying SD Logic to physical distribution and logistics management", International Journal of Logistics, editors: Ron Fisher, Robert Lusch, and Stephen Vargo.

| **Journal** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Journal of the Academy of Marketing Science | 15 | 11% | [1][26][71][78][113][164][183][186] [187][200] [202][234][308][309][327] |
| Marketing Theory | 13 | 9% | [45][47][55][61][85][106][109][172] [178][236] [237][264][318] |
| Industrial Marketing Management | 9 | 7% | [27][32][86][87][108][170][185][239] [311] |
| Journal of Service Management | 9 | 7% | [10][31][77][80][91][110][121][123] [297] |
| Australasian Marketing Journal | 6 | 4% | [49][104][147][286][305][326] |
| European Management Journal | 4 | 3% | [88][219][226][312] |
| Journal of Business & Industrial Marketing | 4 | 3% | [25][50][115][306] |
| Journal of Service | 4 | 3% | [9][46][206][225] |

| | | | |
|---|---|---|---|
| Research | | | |
| Decision Sciences | 3 | 2% | [48][224][231] |
| European Journal of Marketing | 3 | 2% | [149][180][296] |
| Journal of Business Market Management | 3 | 2% | [56][111][310] |
| Journal of Marketing Management | 3 | 2% | [30][119][300] |
| Journal of Services Marketing | 3 | 2% | [24][220][238] |
| Managing Service Quality | 3 | 2% | [112][295][315] |
| Marketing Review | 3 | 2% | [116][124][190] |
| Remaining 47 journals | 55 | 39% | |

**Table 29: Group 3 – Journal distribution of publications**

*Authors*

The analysis reveals the presence of two main authors, considered as the "fathers" of the field: Stephen Vargo and Robert Lusch. Vargo is Professor of Marketing at the University of Hawaii, (USA), while Lusch is Professor of Marketing and Head of the Marketing Department in the Eller College of Management at the University of Arizona (USA). Mostly, the authors come from business schools and marketing departments.

| **Author** | **Affiliation** | **# of articles** | **Articles reference numbers** |
|---|---|---|---|
| Vargo, S.L. | College Of Business Administration, University of Hawai'i, (USA) | 19 | [55][57][178][179][180][181] [182][183][184][188][200] [305][306][307][308][309] [310][311][312] |
| Lusch, R.F. | Eller College of Management, University of Arizona (USA) | 13 | [177][178][179][180][181] [182][183][184][307][308] [309][310][311] |
| Edvardsson, B. | Faculty of Economy, Communication and IT, Karlstad University | 6 | [297][315] |

| | | | |
|---|---|---|---|
| | (Sweden) | | |
| Grönroos, C. | Hanken Swedish School of Economics (Finland) | 5 | [106][107][108][109][110] |
| Ballantyne, D. | Department of Marketing, University of Otago (New Zealand) | 4 | [24][25][26][27] |
| Baron, S. | University of Liverpool Management School (UK) | 4 | [30][31][32][119] |
| Brodie, R.J. | The University of Auckland Business School (New Zealand) | 4 | [45][46][47][326] |
| Maglio, P.P. | IBM Almaden Research Center (USA) | 4 | [187][188][224][312] |
| Tronvoll, B. | Oslo School of Management (Norway) | 4 | [78][295][296][297] |
| Frow, P. | Faculty of Economics and Business, University of Sydney (Australia) | 3 | [27][234][235] |
| Gummesson, E. | Stockholm University School of Business (Sweden) | 3 | [113][114][115] |
| Harris, K. | Business School, University of Lincoln (UK) | 3 | [30][31][119] |
| Ordanini, A. | Department of Marketing, Bocconi University (Italy) | 3 | [224][225][226] |
| Payne, A. | Australian School of Business, University of New South Wales (Australia) | 3 | [27][234][235] |
| Storbacka, K. | Nyenrode Business University (The Netherlands) | 3 | [147][234][235][278] |
| Wilson, H. | Marketing, Cranfield School of Management, | 3 | [159][164][185] |

| | | | |
|---|---|---|---|
| | Cranfield University (UK) | | |

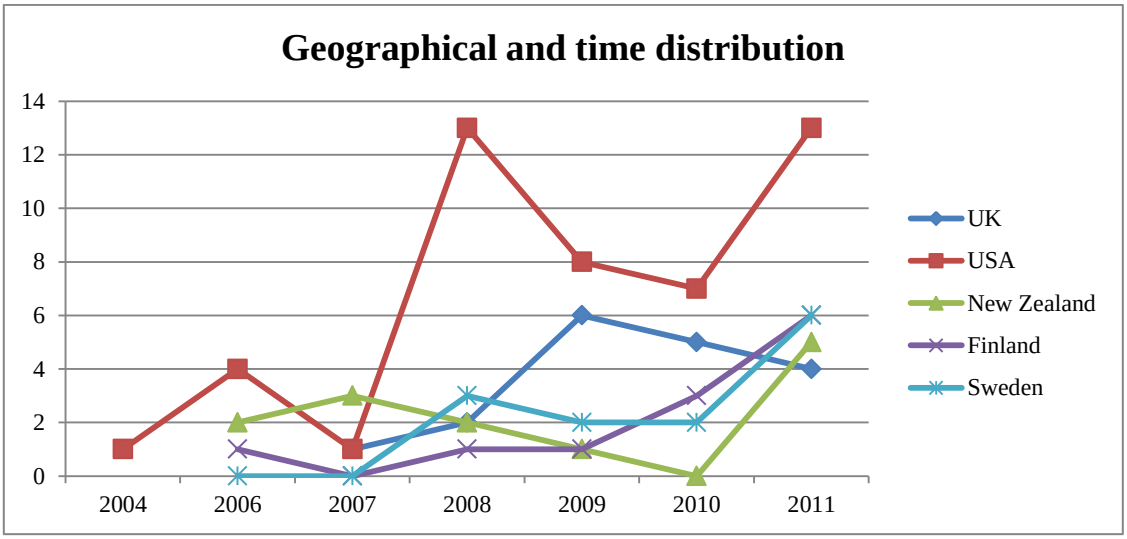
**Table 30: Group 4 – Reference authors**

*Origin*

Geographically, the papers reviewed originate in the USA (34%), followed by UK (13%), New Zealand (9%), Sweden (9%) and Finland (9%).

| Origin | # of articles | % of articles | Articles reference numbers |
|---|---|---|---|
| USA | 47 | 34% | [1][8][18][29][50][55][56][57][70][71][85][86][88] [89][111][139][164][167][171][177][178][179] [180][181][182][183][184][186][187][188][200] [202][216][231][243][244][249][292][305][306] [307][308][309][310][311][312][330] |
| UK | 18 | 13% | [30][31][32][69][119][159][185][190][203][219] [237][271][276][300][301][318][320][326] |
| New Zealand | 13 | 9% | [24][25][26][27][45][46][47][49][101][104][124] [239][323] |
| Sweden | 13 | 9% | [28][76][77][80][91][113][114][115][148][149] [170][297][315] |
| Finland | 12 | 9% | [106][107][108][109][110][112][120][121][123] [129][147] [168] |
| Australia | 6 | 4% | [9][234][235][264][286][319] |
| France | 6 | 4% | [37][61][87][116][236][238] |
| Norway | 5 | 4% | [10][78][295][296][327] |
| Germany | 3 | 2% | [97][172][206] |
| Italy | 3 | 2% | [224][225][226] |
| Canada | 2 | 1% | [48][232] |
| China | 2 | 1% | [59][328] |
| Poland | 2 | 1% | [62][220] |
| Others | 6 | 6% | [11][54][158][176][217][302] |

**Table 31: Group 4 - Geographical distribution of publications**




**Graph 11: Group 4 - Geographical and time distribution of publications**

*Industry sectors*

Practical applications and investigations are a few and very sparse on a high variety of sectors, referring non only to the manufacturing industry, but also to pure service sectors such as health care, hospitality, restaurants and tourism.

| **Industry category** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Manufacturing | 7 | 5% | [70][76][114][148][170][171][236] |
| Tourism and travels | 6 | 4% | [9][31][77][91][120][167] |
| Health care | 4 | 3% | [54][112][168][286] |
| Hospitality | 3 | 2% | [224][225][271] |
| Restaurant | 2 | 1% | [119][315] |
| Others | 13 | 9% | [30][32][37][59][69][80][129][159][176][219][226][243][319] |
| None | 100 | 70% | [1][8][10][11][18][24][25][26][27][28][29][45][46][47][48][49][50][55][56][57][61][62][71][78][85][87][88][89][97][101][104][106][107][108][109][110][111][113][115][116][121][123][124][139][147][149][158][164][172][177][178][179][180][181][182][183][184][186][187][188][190][200][202][203][206][216][217][220][231][232][234][235][237] |

| | | | |
|---|---|---|---|
| | | | [238][239][244][249][264][276][292][295] [296][297][300][301][302][305][306][307] [308][309][310][311][312][318] [320][323][326][328][330] |

**Table 32: Group 4 – Distribution of publications by sectors**

*2. Definitional issues*

*Approaches to definitions*

The different definitions, developed by the authors ore quoted from other articles, are reported in Table 33.

| **Service Dominant Logic (SDL)** | |
|---|---|
| Brodie et al., 2011 [47] | "In a broad sense S-D logic can be considered as an emerging paradigm or as a school of thought" |
| Lusch et al., 2006a [181] | "Service-dominant logic is more of a philosophy and perspective than a theory. It is a lens for viewing market exchange processes more clearly" |
| Lusch et al., 2006b [182] | "S-D logic is more than a series of premises and propositions; it is a revised logic of market exchange that informs a revised logic of competing through service" |
| Vargo, 2007 [305] | "S-D logic represents a shift in logic of exchange, not just a shift in type of product that is under investigation. As the name indicates, S-D logic is just that, a logic. It is a framework and a mindset for organizing the micro theory building taking place throughout marketing and elsewhere" |
| http://sdlogic.net/index.html | "Service-Dominant (S-D) Logic is a mindset for a unified understanding of the purpose and nature of organizations, markets and society" |

**Table 33: Group 4 - Definitions**

Comparing the definitions, there seems to be consensus on defining the Service Dominant Logic of Marketing as a *new way to create value*.

*Discipline bases*

Most of the publications are related to Marketing (76%), stressing in particular the concept of value co-creation and co-production with the customer. The Supply Chain

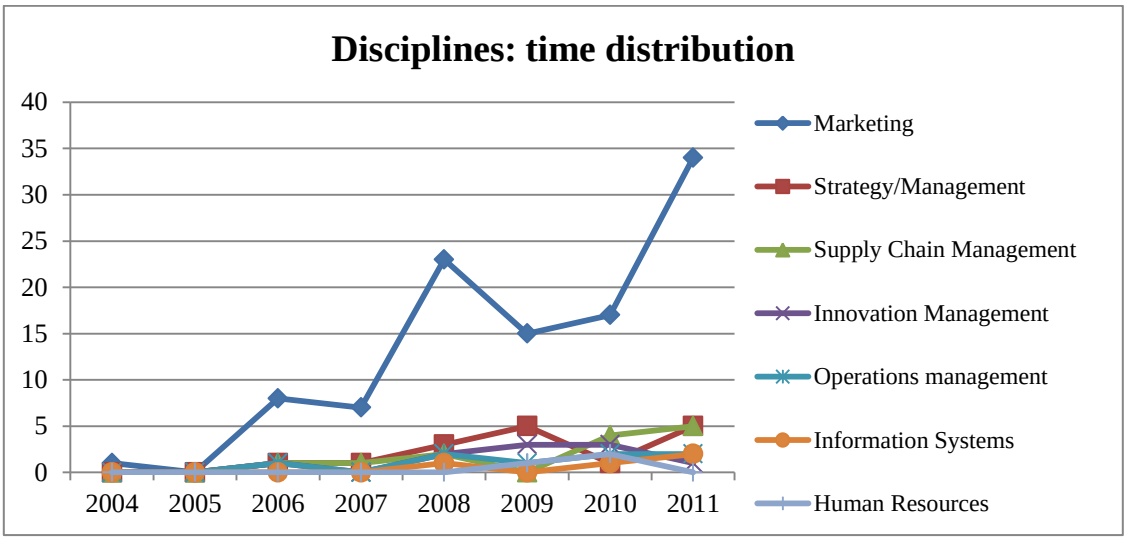
Management discipline is gaining attention within the SDL domain, with a focus on the impacts of this new logic on the value creation network.

| **Discipline** | **# of articles** | **% of articles** | **Main topics** | **Articles reference numbers** |
|---|---|---|---|---|
| Marketing | 105 | 76% | Value co-creation and co-production, brand and relationship management | [1][8][9][11][18][24][25] [26][27][30][31][32][37] [45][46][47][48][49][50] [54][55][56][57][59][61] [71][76][77][78][85][86] [87][89][91][97][104][106] [107][108][109][110][111] [112][113][114][115][116] [119][120][121][123][124] [139][147][149][158][159] [164][167][170][176][177] [178][179][180][181][182] [183][184][185][186][190] [200][202][206][216][220] [232][234][235][236][237] [238][243][244][264][271] [286][295][296][300][305] [306][307][308][309][310] [311][312][315][318][319] [323][326][327] |
| Strategy / Management | 16 | 12% | Resources, strategic implications | [28][29][50][62][70][80] [104][129][139][148][182] [184][187][188][219][237] |
| Supply Chain Management | 13 | 9% | Value creation network | [168][170][171][177][182] [183][184][232][244][249] [292][302][330] |
| Innovation Management | 10 | 7% | Service innovation | [56][85][190][202][203] [217][224][225] [231][301] |
| Operations management | 8 | 6% | Operations strategy and processes | [8][97][114][168][182][184] [276][330] |
| Information Systems | 4 | 3% | Information management | [97][226][239][328] |
| Human | 3 | 2% | Employees and | [10][69][101] |

| | | | | |
|---|---|---|---|---|
| Resources | | | staff | |
| Others | 4 | 3% | | [88][172][297][320] |

**Table 34: Group 3 – Distribution by discipline**

The time-based tendency of each discipline is depicted in Graph 12.




**Graph 12: Group 3 - Time distribution of disciplines**

*3. Theoretical concerns*

*Theoretical perspective*

The SDL is based on ten foundational premises (originally eight – Vargo and Lusch. 2004), reported in Table 35.

| FPs | Statement | Comment/explanation |
|---|---|---|
| FP1 | Service is the fundamental basis of exchange | The application of operant resources (knowledge and skills), "service," as defined in S-D logic, is the basis for all exchange. Service is exchanged for service |
| FP2 | Indirect exchange masks the fundamental basis of exchange | Because service is provided through complex combinations of goods, money, and institutions, the service basis of exchange is not always apparent |
| FP3 | Goods are a distribution mechanism for service provision | Goods (both durable and non-durable) derive their value through use – the service they provide |

| | | |
|---|---|---|
| FP4 | Operant resources are the fundamental source of competitive advantage | The comparative ability to cause desired change drives competition |
| FP5 | All economies are service economies | Service (singular) is only now becoming more apparent with increased specialization and outsourcing |
| FP6 | The customer is always a co-creator of value | Implies value creation is interactional |
| FP7 | The enterprise cannot deliver value, but only offer value propositions | Enterprises can offer their applied resources for value creation and collaboratively (interactively) create value following acceptance of value propositions, but can not create and/or deliver value independently |
| FP8 | A service-centered view is inherently customer oriented and relational | Because service is defined in terms of customer-determined benefit and co-created it is inherently customer oriented and relational |
| FP9 | All social and economic actors are resource integrators | Implies the context of value creation is networks of networks (resource integrators) |
| FP10 | Value is always uniquely and phenomenologically determined by the beneficiary | Value is idiosyncratic, experiential, contextual, and meaning laden |

**Table 35: Service Dominant Logic –Ten foundational premises (Vargo and Lusch, 2008)**

Basically, it is stressed the notion of service as "the application of specialised competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself" (Vargo and Lusch, 2004), and it is argued that all firms are service firms; all markets are centred on the exchange of service, and all economies and societies are service based.

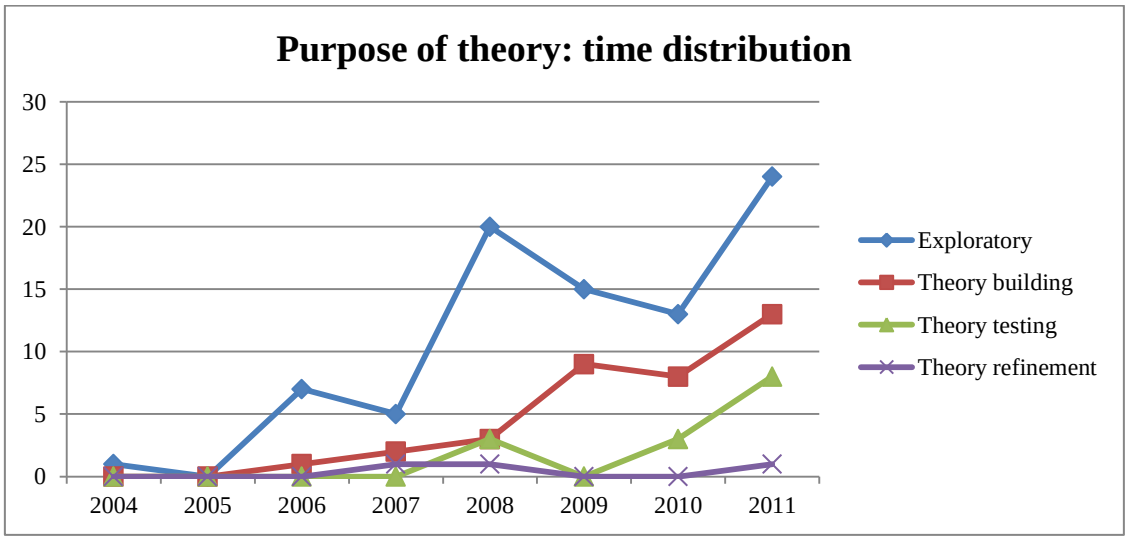
Publications of this field are mainly built around the ten FPs.

*Purpose of theory*

The analysed papers mainly refer to the exploratory (62%) phase, indicating that also SDL is still in an early stage and needs further research activities to develop new theory.

| Purpose | # of articles | % of articles | Articles reference numbers |
|---|---|---|---|
| Exploratory | 85 | 62% | [1][8][18][24][25][26][27][28][29][30][32][37] [45][47][57][61][76][78][85][87][88][89][101] [104][106][107][108][110][111][112][113][114] [115][119][120][121][123][124][139][147][148] [167][168][170][172][177][178][179][180][181] [183][184][186][187][188][190][200][202][203] [216][219][220][226][236][238][239][249][264] [271][276][286][292][297][301][305][306][307] [309][310] [311][312][318][319][320] [326] |
| Theory building | 36 | 26% | [11][31][46][48][50][55][56][62][80][91][97] [116][129][149][159][164][176][182][185][206] [217][224][231][232][234][235][237][244][295] [296][300][302][308][323][328][330] |
| Theory testing | 14 | 10% | [9][10][54][59][69][70][71][77][86][171][225] [243][315][327] |
| Theory refinement | 3 | 2% | [49][109][158] |

**Table 36: Group 3 - Distribution of publications in accordance with the purpose of theory**




**Graph 13: Group 3 – Time distribution of the purpose of theory**

*4. Research methodological issues*

*Research and data collection methods*

Results of classifying the articles according to research methods adopted are shown in Table 37.

| **Method** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| *Analytical* | *93* | *67%* | |
| Conceptual | 93 | 67% | [1][8][18][24][25][26][27][28][29][45][46][47] [48][49][50][55][56][57][61][62][78][85][87] [88][89][97][101][104][106][107][108][109] [110][111][113][116][119][121][123][124][139] [148][149][158][167][172][176][177][178][179] [180][181][182][183][184][186][187][188][200] [202][206][216][217][220][231][232][234][237] [238][239][249][264][276][292][295][296][297] [300][302][305][306][307][308][309][310][311] [312][318][320][323][326][328][330] |
| | | | |
| *Empirical* | *45* | *33%* | |
| Case based | 21 | 15% | [11][30][76][80][114][115][120][129][147] [159][168][170][185][190][219][226][235][236] [271][286][301] |
| Survey | 16 | 12% | [9][54][59][69][70][86][91][112][164][171] [203][224][225][243][315][327] |
| Interviews | 4 | 3% | [31][37][244][319] |
| Scenario-based analysis | 2 | 1% | [10][71] |
| Experiment | 1 | 1% | [77] |
| Secondary data analysis | 1 | 1% | [32] |

**Table 37: Group 3 – Methodological classification**

Almost 70% of the articles were classified as analytical, showing the necessity of a more rigorous empirical research process, based on real-life applications and both successful and unsuccessful experiences.

#### *2.4.1.4 Group 4: Integrated Solutions*

The database of this group counts for 45 articles. Among the 9 keywords identified to search for articles, the term solution (integrated and customer) seems to be the most used (49% and 18%).

| **Search keyword** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Integrated solution | 24 | 49% | [39][40][42][52][64][65][66][133] [136][138][144][151][153][154] [162][166][193][203][261][272] [278][313][324][325] |
| Customer solution | 9 | 18% | [38][48][270][274][293][299][303] [313][317] |
| Integrated product service offering | 4 | 8% | [17][63][84][140] |
| Functional product | 3 | 6% | [6][7][191] |
| Total care product | 3 | 6% | [6][7][262] |
| Full-service contracts | 2 | 4% | [44][280] |
| Functional sales | 2 | 4% | [258][282] |
| Extended product | 1 | 2% | [274] |
| Hybrid product | 1 | 2% | [145] |
| Total | 45[16] | 100% | |

**Table 38: Group 4 – Distribution of keywords**

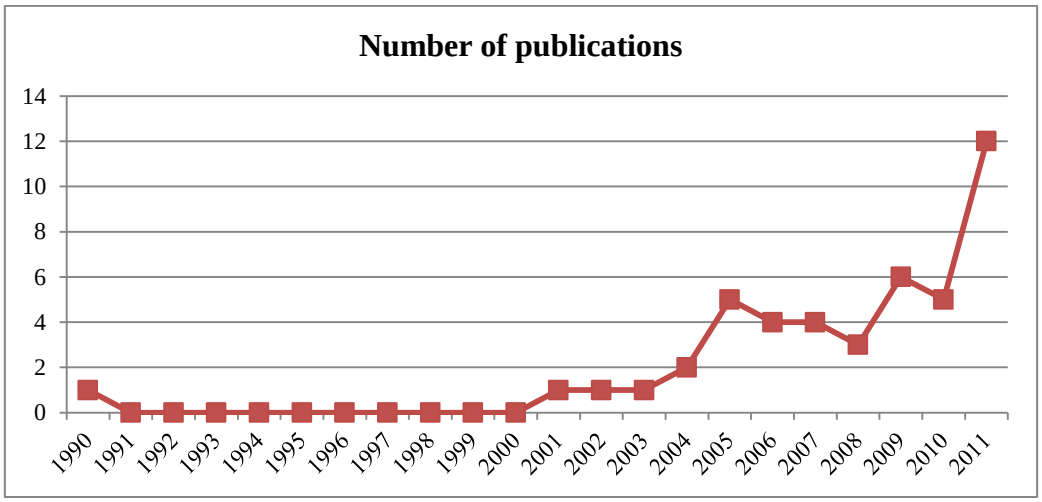
*1. Descriptive features*

*Time distribution of publications*

An analysis of the years in which the selected articles were published shows that the first publication appeared in 1990, written by Sandra Vandermerwe, a pioneer of the

[16] The total number of reviewed articles does not correspond to the arithmetic sum since some articles were related to more than one search keyword.

notion that including services in a product portfolio adds value, addressing the customer solution topic and the impact on the marketing strategy. To her is also attributable the first paper appeared on *servitization* and the first definition of this concept. Then, no paper was published until 2000, when the number of articles started rising, with 23 out of the 45 articles published between 2009 and 2011, demonstrating that the field is a relatively new one.




**Graph 14: Group 4 - Time distribution of publications**

*Journal titles*

This analysis showed a very fragmented situation, with 10 articles published on the Industrial Marketing Management (2010 Impact Factor: 1,694), and the remaining 35 articles spread over 27 journals, from a vast array of backgrounds.

A special issue on "Service and Solution Innovation", directly referring to "business-to business services" (Evanschitzky et al., 2011) was published on Industrial Marketing Management (Volume 40, Issue 5) in 2011, edited by David M. Woisetschläger, Florian V. Wangenheim and Heiner Evanschitzky. [261][270][278][293]

| **Journal** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Industrial Marketing Management | 10 | 22% | [66][138][166][261][270][278] [280][293][324][325] |
| International Journal of Project Management | 3 | 7% | [40][153][154] |

| | | | |
|---|---|---|---|
| International Journal of Services, Technology and Management | 3 | 7% | [84][274][317] |
| Industrial and Corporate Change | 2 | 4% | [52][64] |
| International Journal of Operations and Production Management | 2 | 4% | [42][63] |
| Journal of Cleaner Production | 2 | 4% | [230][282] |
| Journal of Engineering Design | 2 | 4% | [6][7] |
| Remaining 21 Journals | 21 | 47% | |

**Table 39: Group 4 – Journal distribution of publications**

*Authors*

The analysis by authors indicates a quite fragmented situation, where two authors have written 5 and 4 papers each:

- Andrew Davies from the Tanaka Business School, Imperial College London, UK ("Imperial College Business School conducts world class research in management with a particular focus on: i) Innovation & Entrepreneurship; ii) Organisation & Management; iii) Healthcare Management; and iv) Finance"[17]);
- Tim Brady from the Centre for Research in Innovation Management, Brighton University, UK ("CENTRIM's goal is to work with our partners in industry, government and other organisations to provide exciting new insights into innovation dynamics — and to help improve the innovation performance of organisation"[18]).

Largely, the authors come from both business and engineering departments.

[17] http://www3.imperial.ac.uk/business-school
[18] http://centrim.mis.brighton.ac.uk/

| Author | Affiliation | # of articles | Articles reference numbers |
|---|---|---|---|
| Davies, Andrew | Tanaka Business School, Imperial College London (UK) | 5 | [39][40][64][65] [66] |
| Brady, Tim | Centre for Research in Innovation Management, Brighton University (UK) | 4 | [39][40][65][66] |
| Aaltonen, Pertti | BIT (Business, Innovation, Technology) Research Centre, Helsinki University of Technology (Finland) | 2 | [153][154] |
| Artto, Karlos | Department of Industrial Engineering and Management, Helsinki University of Technology (Finland) | 2 | [153][154] |
| Gann, David | Innovation Studies Centre, Imperial College London (UK) | 2 | [39][40] |
| Sundin, Erik | Department of Management and Engineering, Linköping University (Sweden) | 2 | [258][282] |
| Turkulainen, Virpi | BIT (Business, Innovation, Technology) Research Centre, Helsinki University of Technology (Finland) | 2 | [153][154] |
| Alonso-Rasgado, Teresa | Department of Mechanical, Aerospace and Civil Engineering, University of Manchester (UK) | 2 | [6][7] |
| Hobday, Michael | The Freeman Centre, University of Sussex (UK) | 2 | [65][66] |
| Kujala, Saara | Aalto University, School of Science and Technology (Finland) | 2 | [153][154] |
| Lakemond, Nicolette | LiU School of Management, Linköping University (Sweden) | 2 | [324][325] |

| | | | |
|---|---|---|---|
| Roy, Rajkumar | School of Applied Science, Cranfield University (UK) | 2 | [17][63] |
| Thompson, Graham | Department of Mechanical, Aerospace and Civil Engineering, University of Manchester (UK) | 2 | [6][7] |
| Windahl, Charlotta | LiU School of Management, Linköping University (Sweden) | 2 | [324][325] |

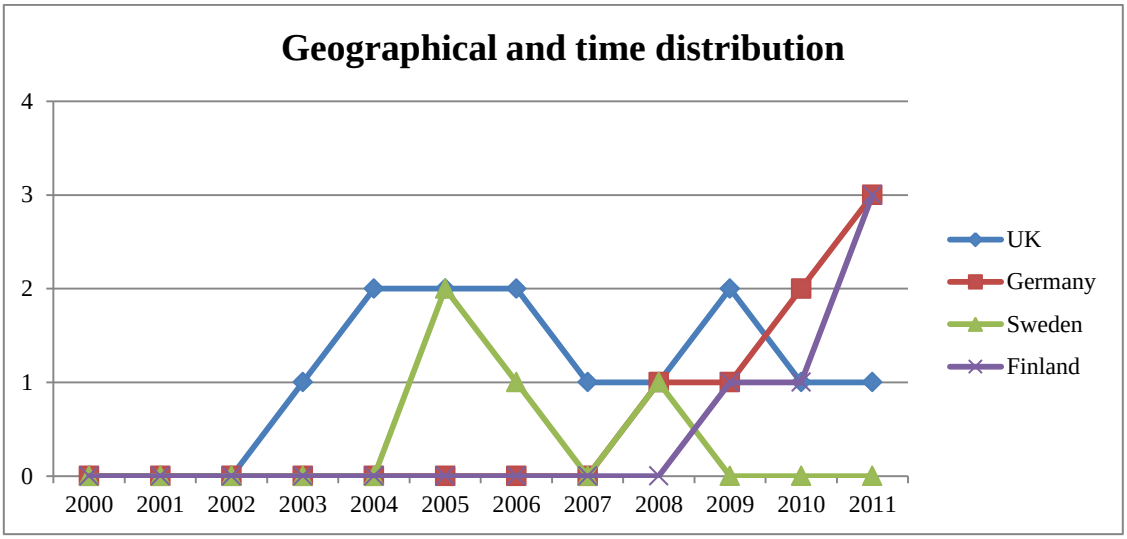
**Table 40: Group 4 – Reference authors**

*Origin*

Geographically, the papers reviewed originate in the UK (29%), Germany (15%), Finland (11%) and the rest (47%) all over the world.

| **Origin** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| UK | 13 | 29% | [6][7][17][39][40][64][65][66][136][138][140][162] [274] |
| Germany | 7 | 15% | [38][133][144][193][258][293][313] |
| Finland | 5 | 11% | [42][153][154][261][278] |
| Sweden | 4 | 9% | [151][262][282][324] |
| USA | 3 | 7% | [44][270][272] |
| Norway | 2 | 4% | [145][191] |
| The Netherlands | 2 | 4% | [84][280] |
| Others | 9 | 20% | [48][52][63][166][230][299][303][317][325] |
| Total | 45 | 100% | |

**Table 41: Group 4 - Geographical distribution of publications**




**Graph 15: Group 4 - Geographical and time distribution of publications**

*Industry sectors*

Table 42 shows that more than half of the articles were based in the manufacturing industry sector. A closer examination showed that for the majority of articles classified as manufacturing, most dealt with selling products or assets in a Business to Business (B2B) context (aerospace, machinery, train and signalling systems, etc.).

| **Industry category** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Manufacturing | 25 | 56% | [17][40][42][44][64][65][66][136][140][151] [166][191][193][258][261][262][274][278][280] [282] [293][303][317][324][325] |
| Construction | 7 | 16% | [39][64][65][66][136][162][278] |
| Communication | 4 | 9% | [64][65][66][278] |
| Power supply | 3 | 7% | [153][154][270] |
| Government, administration and defence | 2 | 4% | [63][138] |
| Information Technology | 2 | 4% | [52][299] |
| Mining | 1 | 2% | [278] |
| Finance | 1 | 2% | [299] |
| Food | 1 | 2% | [230] |
| Health care | 1 | 2% | [299] |
| None | 10 | 22% | [6][7][38][48][84][133][144][145][272][313] |

**Table 42: Group 4 – Distribution of publications by sectors**

*2. Definitional issues*

*Approaches to definitions*

The different definitions, developed by the authors, or quoted from other articles, are reported in Table 43.

| **Functional (total care) product - Functional sales** | |
|---|---|
| Sandberg et al., 2005 [262] | "Functional Product is a total care product, where the company offers the functionality of the product, compromising hardware and support services, e.g., maintenance, logistics, financing, and training over the life-time of the offer." |
| Alonso-Rasgado and Thompson, 2006 [6] | "Total Care Products are innovative packages consisting of hardware and services integrated to provide a complete functional provision." |
| Alonso-Rasgado et al., 2004 [7] | "Functional products, also known as 'total care products', are products that comprise combinations of 'hard' and 'soft' elements. Typically, they are described as comprising hardware combined with a service support system." |
| Sakao et al., 2008 [258] | Functional sales: "...to offer a functional solution that fulfils a defined customer need. The focus is, with reference to the customer value, to optimise the functional solution from a life-cycle perspective. The functional solution can consist of combinations of systems, physical products and services." Modified from Lindahl and Olundh, 2001 |
| **Full service** | |
| Stremersch et al., 2001 [280] | Full service is a "comprehensive bundles of products and/or services, that fully satisfy the needs and wants of a customer related to a specific event or problem." |
| **Hybrid product** | |
| Shankar et al., 2009 | "Hybrid solutions are products and services combined into innovative offerings" |
| **Integrated solutions** | |
| Ceci and Masini, 2011 [52] | "With 'integrated solutions' we refer to 'a business model that combines products and services into a seamless offering that addresses a pressing customer need" |
| Knutsen et., 2011 [145] | Hybrid products are "products that are connected to on-line services, that are based around digital data and then rely on digital networks to function." |
| Salonen, 2011 [261] | Solutions are "individualized offers for complex customer problems that are interactively designed and whose components offer an integrative added value by combining products and/or services so that the value is more than the sum of the components." |

| | |
|---|---|
| Storbacka, 2011 [278] | Integrated solutions are "longitudinal relational processes, during which a solution provider integrates goods, service and knowledge components into unique combinations that solve strategically important customer specific problems, and is compensated on the basis of the customer's value-in-use." |
| Brady et al, 2003 | Integrated solutions are "complete business solutions which involve the integration of products and services into one package" |
| Miller et al., 2002 | Integrated solutions: integrated combinations of products and/or services are unusually tailored to create outcomes desired by specific clients or client types |
| Brax and Jonsson, 2009 [42] | "We define an integrated solution offering as a bundle of physical products, services and information, seamlessly combined to provide more value than the parts alone, that addresses customer's needs in relation to a specific function or task in their business system; it is long-term oriented, integrates the provider as part of the customer's business system, and aims at optimizing the total cost for the customer." |
| Windahl and Lakemond, 2010 [325] | "With integrated solutions, a combination of physical products or services, or both, plus knowledge are used to provide a specific outcome fulfilling the customer's needs." |
| **Solution - Customer solution** | |
| Johansson et al., 2003 | "A solution is a combination of products and services that creates value beyond the sum of its parts." |
| Sawhney, 2006 | "I define a solution as an integrated combination of products and services customized for a set of customers that allows customers to achieve better outcomes than the sum of the individual components." |
| Davies et al., 2006 [65] | "A solution is a customised and integrated combination of goods and services for meeting a customer's business need." |
| Evanschitzky et al., 2011 | "Solutions are individualized offers for complex customer problems that are interactively designed and whose components offer an integrative added value by combining products and/or services so that the value is more than the sum of the components." |
| Galbraith, 2002 | "A customer solution is a combination of products and services." |
| Tuli et al., 2007 [299] | "...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." |

**Table 43: Group 4 - Definitions**

Analysing the several definitions, it is clear that the terms *Functional (total care) product, Functional sales, Full service, Integrated solutions, Solution, Hybrid product* and *Customer solution* could be considered as synonymous, and they refer to:

- a customised and integrated;
- combination of product (physical goods) and services;
- offered to provide outcomes and functionalities desired by the customers.

A slight different view is embraced by Tuli et al. (2007) and Storbacka (2011), who investigate the concept of solution from a customer's point of view and define it as a set of relational processes.

*Discipline bases*

The papers collected in Group 4 are not exclusively possessed by a specific discipline[19]. They are rather a focal point for several disciplinary research fields, each investigating landscapes from different perspectives.

| **Discipline** | **# of articles** | **% of articles** | **Main topics** | **Articles reference numbers** |
|---|---|---|---|---|
| Strategy / Management | 23 | 52% | Business model configuration, source of competitive advantage, challenges, benefits, organisational issues, capabilities and transition trajectories | [17][38][39][40][52] [64][65][66][136][144] [153][154][162][191] [193][258][261][272] [278][280][317][324] [325] |
| Design / Engineering | 6 | 14% | Design process and methods | [6][7][140][145][230] [262] |
| Marketing | 6 | 14% | Customer focus and perspective and pricing | [138][166][270][293] [299][303] |
| Operations management | 5 | 11% | Processes, quality management, operations strategy | [42][63][133][274] [282] |
| Information System | 2 | 5% | Information and knowledge management | [44][48] |
| Innovation Management | 2 | 5% | Dimensions of innovation | [84][151] |

**Table 44: Group 4 – Distribution by discipline**

[19] [313] is not considered in this classification since it is based on a systematic literature review of hybrid value creation.

While the term *Customer Solution* is more used in the marketing literature, *Integrated Solution* is more popular in the strategy and management discipline, and *Total Care (Functional) Produc*t in the design and engineering field.

The classification shows that the largest grouping of articles is based in the Strategy and Management discipline area (52%), that investigates a wide range of aspects, from the configuration of a company's business model, to the definition of challenges, benefits and strategic trajectories, emphasising the need for multidisciplinary cooperation across several functional areas to maximise the efficiency in providing integrated solutions for customer. This is followed by Design/Engineering (14%) and Marketing (11%) areas. Very few articles focus on operations, supply chain, information and human resource management issues.

*3. Theoretical concerns*

*Theoretical perspective*

As for Group 1, a first set of paper explores the level of implementation of integrated solutions in different countries, as Germany and Italy (Kinkel et al., 2011; Sakao et al., 2008), and sectors, for example construction (Brady et al., 2005a) and Information Technology (Ceci and Masini, 2011). Findings are presented in Table 45.

| | **Findings** |
|---|---|
| Kinkel et al., 2011 | "Product-related services and service innovations significantly contribute to the sales of manufacturing firms."<br>"[…] services are particularly important for manufacturers of complex products and single unit or small batch size manufacturers". |
| Sakao et al., 2008 | RQ 1. Why are P-S offers provided?<br>"Top three driving forces are increased competition, decreasing costs, and improving company brand".<br>RQ 2. What are provided in P-S offers?<br>"The Functional Sales include in most cases physical products and often their maintenance".<br>RQ 3. How are P-S offers provided?<br>"[…] especially small companies often achieve specific design for this type of offers while owning physical products".<br>"[…] mainly two departments of product development and marketing were involved in the P-S offer development". |

| | |
|---|---|
| | "Regarding the usage of development method, a half of the companies use a specific method, while the other half does not".<br>RQ 4. Are there any differences on providing P-S offers between the providers' sizes and, if so, what are they?<br>"Large/medium companies relatively often regard the customer demands, increased competition, and gaining larger product profit as the driving forces, whilst small ones rarely do. More large/medium ones include operators, maintenance, repairs, and take-back responsibility in the P-S offers, while fewer small ones do. The ownership of the physical products often belongs to small-sized providers as opposed to the situation of medium/large ones. In addition, small companies more often design products specifically for the P-S offers than medium/large ones".<br>RQ 5. Are there any differences on providing P-S offers between in Germany and in Italy and, if so, what are they?<br>"Italian companies are approaching the business concept of Functional Sales in a methodical and "dedicated" way". |
| Brady et al., 2005 | "[…] the construction industry had insufficient understanding of value whether in terms of cost, quality or whole-life value. There was no consensus about what is value and how to measure it".<br>"Opinions on who could best play the systems integrator role ranged from anyone in the supply chain/value stream to the prime contractor to the client's representative".<br>"While there were few integrated solutions providers at present, demand is growing especially driven by PPP [*public–private partnership*] policies".<br>"The responses suggest the concept of built environment solutions provision is still at an early stage in its development and that the best opportunity for its introduction is in the context of PFI [*private finance initiative*] in the public sector or large clients who require repeatable solutions in the private sector". |
| Ceci and Masini, 2011 | Emergence of four configurations of IT firms: i) Off-the-shelf solution providers, ii) Resellers, iii) Industry specialists, and iv) Technologists.<br>"[…] the provision of IS [*Integrated Solutions*] is a valuable choice for companies operating in the IT".<br>"Generic IT firms are less profitable than every cluster of IS providers. However, their productivity is actually higher than that of the two configurations without fit [*between environmental homogeneity and specialisation of capabilities*] (resellers and |

| | |
|---|---|
| | industry specialists)".<br>"[…] emergence of a trend towards standardized solutions - which is increasingly appreciated by customers, as they are then free to change IT providers without being locked into a specific business relationship". |

**Table 45: State of the art of integrated solutions in real contexts**

Compared to Group 1, less attention on exploring what are the challenges brought by the introduction of integrated PS offerings. Vandermerwe (1990) identifies two main challenges: how to capture the necessary service skills, and how to organise the firm to handle the complexities of the convergences and networks both within and amongst functions and companies. Broad organisational challenges are proposed by Salonen (2011), in terms of: i) cultural reorientation from products to solutions, ii) external effectiveness at the customer interface, and iii) internal efficiency of operations.

The factors that influence the choice of a *servitized* business model are explored context of a project-based firm by Kujala et al. (2011), who postulate eight propositions, as summarised in Table 46.

| **Identified influencing factor** | **Proposition** |
|---|---|
| Product orientation in the supplier's organization | **P1**. Project suppliers are more likely to deliver a solution with a transactional project delivery business model or with a project led solution business model than with a life-cycle solution business model, when they have strong product orientation in their organisations. |
| The product orientation in the customer's purchasing practices | **P2**. Project suppliers are more likely to deliver a solution with a transactional project delivery business model or with a project led solution business model than with a life-cycle solution business model, when their customers have product-oriented purchasing practices. |
| Customer's maintenance organization | **P3**. Project suppliers are more likely to deliver a solution with a transactional project delivery business model than with a project led solution business model when their customers have a maintenance organisation in place to operate the project product. |
| Skill-level in the customer's | **P4**. Project suppliers are more likely to deliver a |

| | |
|---|---|
| maintenance organization | solution with a project led solution business model than with a transactional project delivery business model, when their customers' maintenance organizations have low capability to operate the project product. |
| The perceived complexity of the supplier's technology | **P5**. Project suppliers are more likely to deliver a solution with a project led solution business model than with a transactional project delivery business model when their customers perceive the project product technology to be highly complex. |
| The customer's financial resources | **P6**. Project suppliers are more likely to deliver a solution with a life-cycle solution business model than with a project led solution business model or with transactional project delivery business model when their customers have limited financial resources available for capital investment in the project. |
| The supplier's marketing approach | **P7**. Project suppliers are more likely to deliver a solution with a life-cycle solution business model or with a project led solution business model than with a transactional project delivery business model when the project supplier has a proactive marketing approach. |
| The focus of the customer's core business | **P8**. Project suppliers are more likely to deliver a solution with a life-cycle solution business model or with a project led solution business model than with transactional project delivery business model when their customer's core business is outside the supplier's offering. |

**Table 46: Influencing factors for project-based firms (Kujala et al., 2011)**

It is evident that most of the influencing factors are fully or partly related to the customer (P2, P3, P4, P6, P8), supporting the idea that customer-orientation is a key feature in *servitized* business models.

Factors affecting solution effectiveness are investigated by Tuli et al. (2007), who identify two categories of variables (supplier and customer variables) and develop eight propositions, as show in Table 47.

| |
|---|
| ***Supplier Variables*** |
| **P1**: The greater the contingent hierarchy in a supplier, the greater is the solution effectiveness. |
| **P2**: The greater the documentation emphasis in a supplier, the greater is the solution effectiveness. |
| **P3**: The greater the incentive externality in a supplier, the greater is the solution effectiveness. |
| **P4**: The greater the customer interactor stability in a supplier, the greater is the solution effectiveness. |
| **P5**: The greater the process articulation in a supplier, the greater is the solution effectiveness. |
| ***Customer Variables*** |
| **P6**: The greater the customer adaptiveness, the greater is the solution effectiveness. |
| **P7**: The greater the customer's political counseling, the greater is the solution effectiveness. |
| **P8**: The greater the customer's operational counseling, the greater is the solution effectiveness. |

**Table 47: Supplier and customer variables affecting solution effectiveness (Tuli et al., 2007)**

On the contrary, publications belonging to Group 4 have a stronger focus on the managerial implications of providing integrated solutions, showing some first attempts to understand how to overcome the challenges.

At a general level, the works provided by Vandermerwe (1990), Brax and Jonsson (2009), Johnstone et al. (2007), Leiringer et al. (2005), Markeset and Kumar (2005) and Shelton (2009), discuss the strategic and managerial implications of offering integrated PS solutions. The different types of existing integrated solutions are proposed by Kapletia and Probert (2010) and by Kujala et al. (2010). In the first paper, through an analysis of the UK defence sector, the authors identify four types of solutions (Figure 17), based on two axes: Customer vs. Product Orientation and Relational Integration vs. Relational Independence. The model is then used to discuss some general managerial implications and challenges.

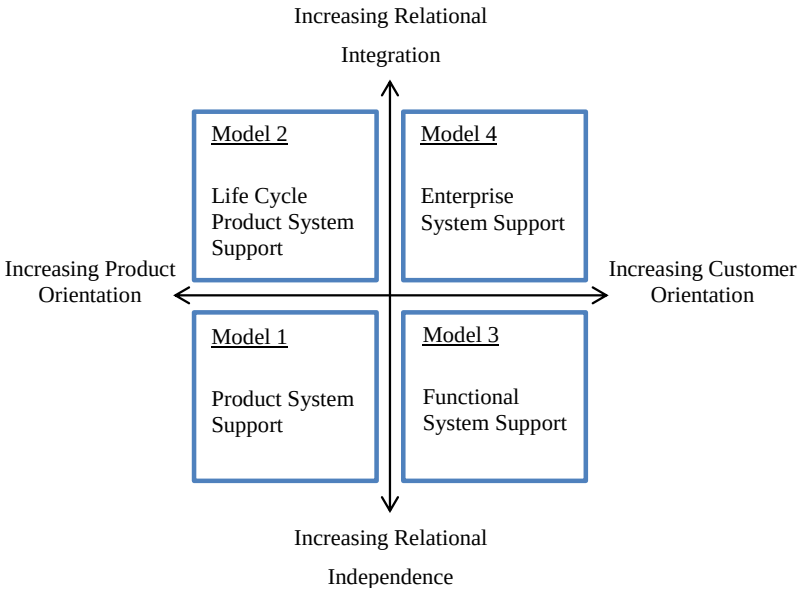



**Figure 17: Four models of solutions (Kapletia and Probert, 2010)**

In the second publication, similarly, the authors develop a framework for analysing business models for integrated solutions, based on two axes: Value proposition for the customer and Revenue generation logic for the supplier. The five types identified are shown in Figure 18.

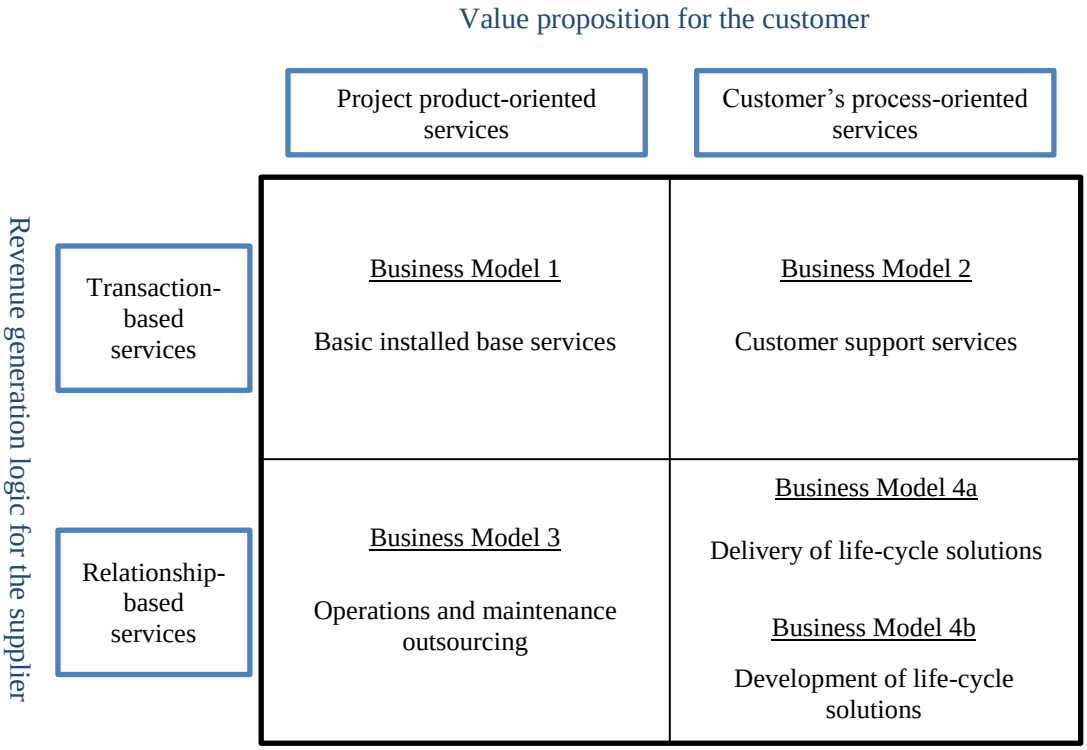



**Figure 18: Typology of five solution-specific business models (Kujala et al., 2010)**

Adopting a dynamic perspective, Matthyssens and Vandenbempt (2010) generate a matrix representing the typologies of service addition strategies, used as a tool to investigate the potential strategic trajectories that may be followed to reach the integrated solution position. The matrix comprising the typologies of service strategies is based on two axes (Added customer value in the offerings and Degree of customization) and is represented in Figure 19.

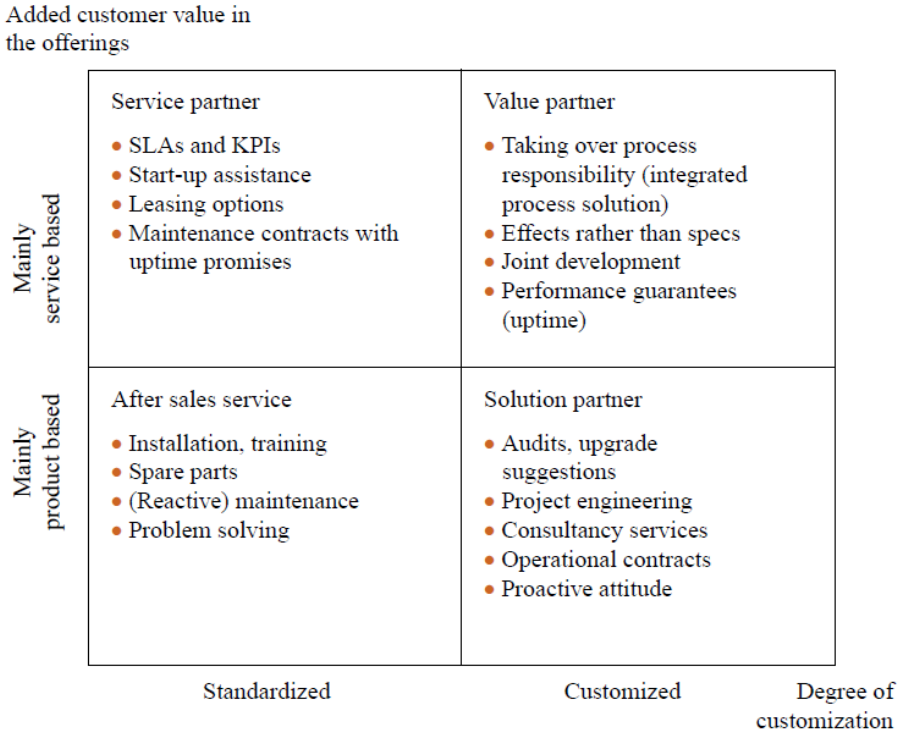



**Figure 19: Typologies of service strategy (Matthyssens and Vandenbempt, 2010)**

The four types of trajectories identified by the authors are proposed in Figure 20 and described in Table 48 in terms of drivers, inhibitors and competences.

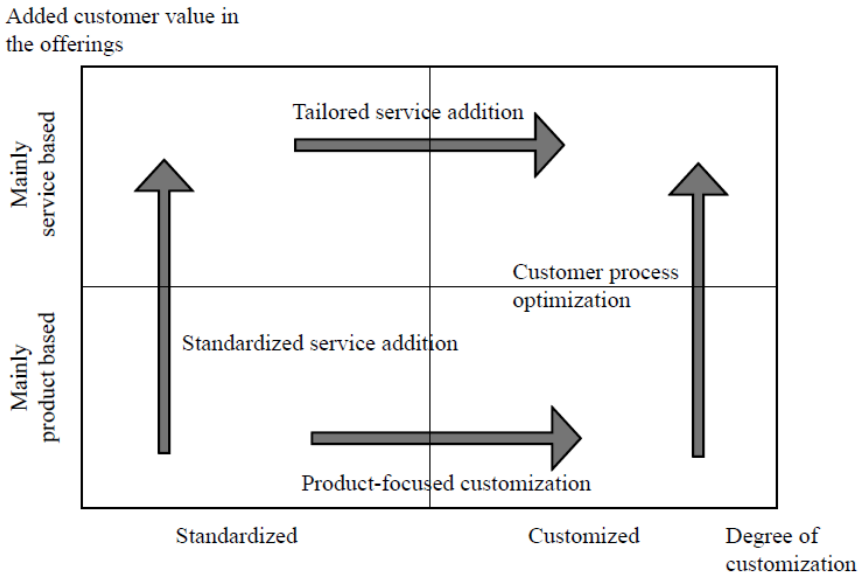



**Figure 20: Strategic trajectories (Matthyssens and Vandenbempt, 2010)**

| | **Product focused customization** | **Customer process optimization** | **Standardized service addition** | **Tailored service addition** |
|---|---|---|---|---|
| Main characteristics | Total cost of capital focus<br>Technical cooperation<br>Joint problem solving<br>Design and engineering | Selling outsourcing solution<br>Offering uptime and process integration | Customer orientation<br>Customer support optimisation | Systems integration<br>Integral solution<br>Supplier guarantees result |
| Drivers | Lack of technical competences at customer<br>Search for de-commoditization and added value | Customer pull (no service department)<br>Differentiation intents<br>Search for de-commoditization and added value | Customer requests<br>Customer application complexity<br>Product complexity<br>Search for de-commoditization and added value | Customer requests<br>Process complexity<br>Search for de-commoditization and added value |
| Inhibitors | Small differences in customer needs difficult "to read"<br>Service mentality lacking | Fears for taking responsibility/ risk perception<br>Some customer requests out of scope | Consistency in service delivery<br>Cost control<br>Diversity of customer industries | Service for free attitude of customers<br>Distance to customer<br>Competence gaps |

| | | | | |
|---|---|---|---|---|
| | | Internal processes not fit<br>Service mentality? | | |
| Competences | Flexibility and agility<br>Customer feedback and input capturing<br>Project management skills | Network competences<br>Advanced monitoring skills<br>Long-term orientation<br>Customer relation management<br>Separate service unit | Technical competences<br>Scaling (back office)<br>Service delivery processes<br>Proactive customer planning/ reporting tools<br>Customer insight | Network competences (experts, adjacencies)<br>Integration skills<br>Customer-centric processes<br>Customer learning<br>Key account management<br>Proactive problem solving ability |

**Table 48: Comparative table of trajectories (Matthyssens and Vandenbempt, 2010)**

At a more detailed level, the publications belonging to Group 4 are polarised around the two challenges proposed by Vandermerwe (1990). Indeed, the first topic investigated is related to the identification of the required capabilities, competences and skills. In particular, Li (2011), grounding his study in a competence-based view of marketing, and identifies two critical competences for the creation of service-based value-added integrated solutions: cross-functional information dissemination and joint development competences. Ceci and Masini (2011), based on contingency theory and resource-based view, stress the importance of the development of appropriate capabilities to support the provision of integrated solutions. Davies (2004) and Brady et al. (2005b) identify four main types of capabilities (system integration, operational service, business consulting and financing) and seven types of skills (key account management, risk analysis and management, financial acumen, legal skills, information management, innovation management, and portfolio management). Davies et al. (2006) go a step further, focusing on organisation capabilities and developing a three-phase capability model for building integrated solutions: i) grow the front end, ii) build the back end, and iii) refocus.

| | Level 1<br>Grow the front end | Level 2<br>Build the back end | Level 3<br>Refocus |
|---|---|---|---|
| **Learning processes** | Explore new approaches and structures for integrated solutions delivery<br><br>Learn from vanguard projects and use tacit knowledge gained in subsequent projects<br><br>Systematically capture and transfer learning from project to project | Explore new approaches and structures that support front-end units<br><br>Develop and implement strategy to replicate solutions-ready components<br><br>Learn from front-end experiences and codify the knowledge gained | Exploit corporatewide learning and leverage knowledge assets<br><br>Strategic center manages front-back and internal-external flows of knowledge |
| **Capability-building** | Front-end capability embodied in vanguard projects<br><br>Move from customized to standardized offerings (e.g., standardized service portfolios for reuse in subsequent projects) | Develop menu of standardized solutions-ready components to support the front end<br><br>Create and refine product platform and services portfolio | Create and refine corporatewide capabilities — front, back and center — which support large-scale and repeatable solutions delivery<br><br>Balance front-end pull of customization and back-end push standardization |
| **Organizational change** | Embed response to new solutions opportunity in:<br>• existing business unit<br>• separate pilot organization<br><br>Work with lead customers<br><br>Use partners to fill gaps in capabilities | Create stand-alone back-end product and/or business units<br><br>Strategic partnerships with major customers<br><br>Strategic partnerships with product and/or service component suppliers | Focus activities of company or business unit on integrated solutions provision<br><br>Move out of peripheral businesses<br><br>Establish structures (front, back and center) that support repeatable solutions delivery<br><br>Prevent back-end units from having direct contact with customers |

**Table 49:Three-phase capability model for building integrated solutions (Davies et al., 2006)**

This paper also explores the impacts of integrated solutions on the organisational configuration, particularly the role of back- and front-end units. Regarding the organisational implications, Davies et al. (2007) does not find any evidence to support the dominance of systems sellers (vertically-integrated firms that produce all the product and service components in a system) or systems integrators (companies that coordinate integration of components supplied by external firms) in firms providing integrated solutions, but a more complex pattern of organisational forms seems to emerge, combining elements of both configurations.

The effects of this new type of offering on pricing models is studied by Bonnemeier et al. (2010), who confront traditional and innovative revenue models in terms of performance parameters, supplier's value proposition, revenue model and parameter for price setting.

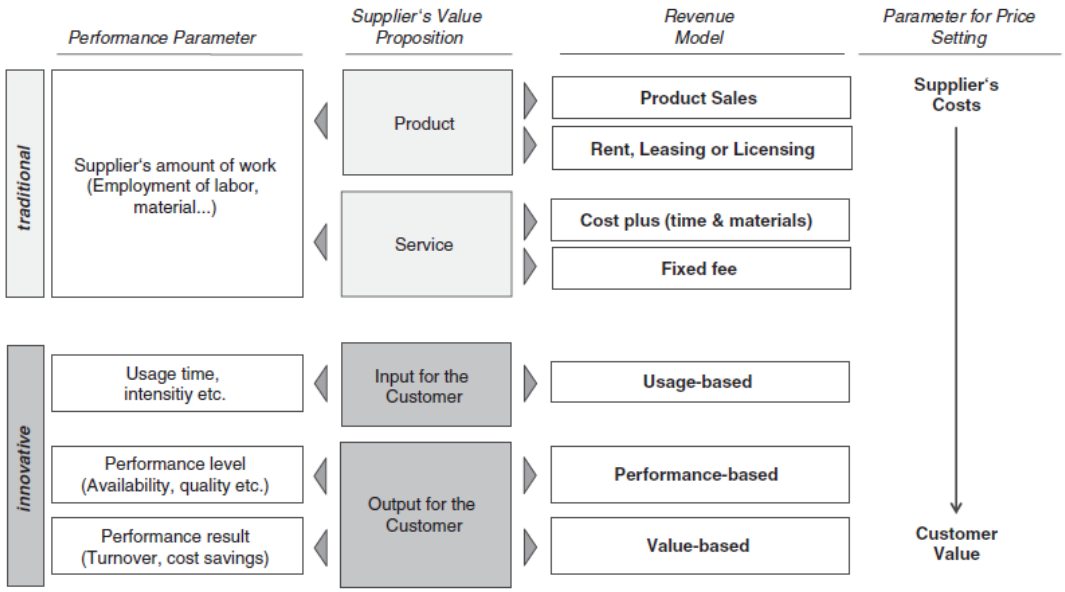



**Figure 21: Traditional versus innovative revenue models (Bonnemeier et al., 2010)**

Using innovative pricing approaches for solutions, based on the value created for the customer, is necessary to make such solutions valuable for a firm. However, applying value-based revenue models makes internal pricing decisions more complex. To facilitate their implementation, the article also develops a generic price management process, depicted in Figure 22, and discusses its implication in the integrated solution domain.


**Figure 22: Generic price management process (Bonnemeier et al., 2010)**

Also Sharma and Iyer (2011) study the strategies that can be used for solution pricing, (traditional, information asymmetry based, and value based), and their pervasiveness. In particular, traditional models are mostly based on products and may have less applicability for pricing services or integrated combinations of products and services. The information asymmetry model relies on accurate knowledge of customers and sellers, something that may not be prevalent among transacting parties. The value model is very relevant, but less used.

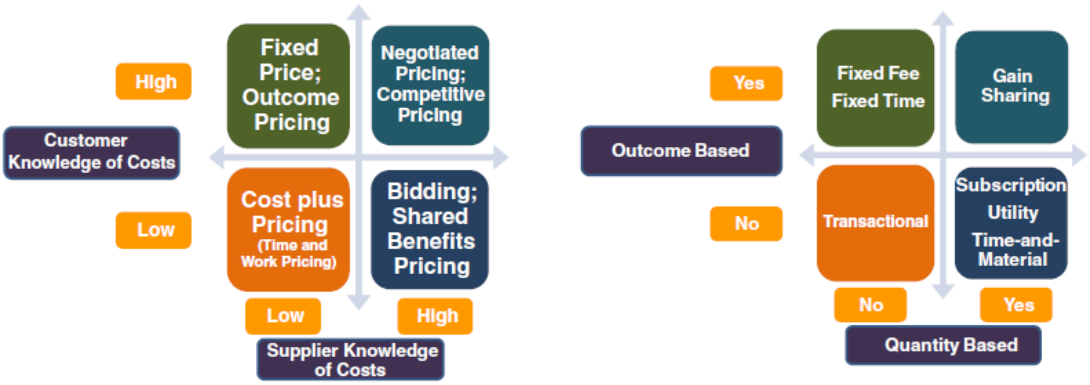



**Figure 23: Information asymmetry-based pricing (left side) and Value-based pricing (right side) framework (Sharma and Iyer, 2011)**

From an Operations point of view, Datta and Roy (2011) discuss key operations strategy dimensions and how they contribute to the successful delivery of performance-based industrial service contracts, through the investigation of two case companies providing engineering service contracts.

| Key framework elements | Contract X and Y delivery success contribution | Benefit Customer | Service provider |
|---|---|---|---|
| Information | Detailed service information, process data, cost data, equipment usage pattern and network wide information | Better availability performance | Reduced cost |
| Service provider operations strategy | (a) Maintenance: "Spend-to-Save" type culture: invest in newer equipment, safety and obsolescence management to reduce dependence on faulty parts | Better availability performance | Reduced cost |
| | (b) Flexibility: accommodating and flexible to varying customer demand, over-looking minor damages by the customer and building joint delivery team | Reduced cost | Good customer relationship and trust, good information flow |
| | (c) External business environment or temporal demographics consideration – use multi-skilling and maintain good strength of trained workforce to hedge | Better availability performance | Improved responsiveness |
| | (d) Developing service oriented culture – managing logistics, scheduling capability upgrades, manpower resource management, customer and supplier relation management, change of internal mindset, removing behavioural silos, fostering partnership | Better availability performance | Improved responsiveness, improved delivery performance and increased future business |
| Customer operations strategy | Partnership: need to partner with whole service provider organisation rather than only a "little-bit" at the base, building joint delivery team | Better availability performance at reduced cost and risks | Improved communication, responsiveness, delivery performance and reduced costs, risks |
| Contract definition | Incentives: need to be designed to result into win-win situation for both parties, cost and risks should be shared equitably (as shown in TPPI type arrangement) | Better availability performance | Reduced risk and better performance |
| | KPIs: should be designed after considering factors as capability, customer affordability, environments, severe conditions of usage and uncertainty; the flexibility in deciding the range is also important | Better availability performance | Better performance |

**Table 50: Attributes for effective service delivery (Datta and Roy, 2011)**

Again in the Operations domain, Johannsen and Leist (2000) explore the possible application of a six sigma improvement program in the context of integrated solution, with a focus on the "Define" phase.

Finally, Alonso-Rasgado et al. (2004) and Alonso-Rasgado and Thompson (2006) develop a design process for the service support system, that comprises all actions requested to ensure that a certain function is provided to a customer. The process is composed by three stages:

- Concept development
  - identification of customer's needs
  - specification of the requirements
  - concept design for service
- System design
  - design details
- Testing and implementation

The concept of a computation tool (Figure 24) is also provided in order to support companies in carrying out the design process in an efficient manner.

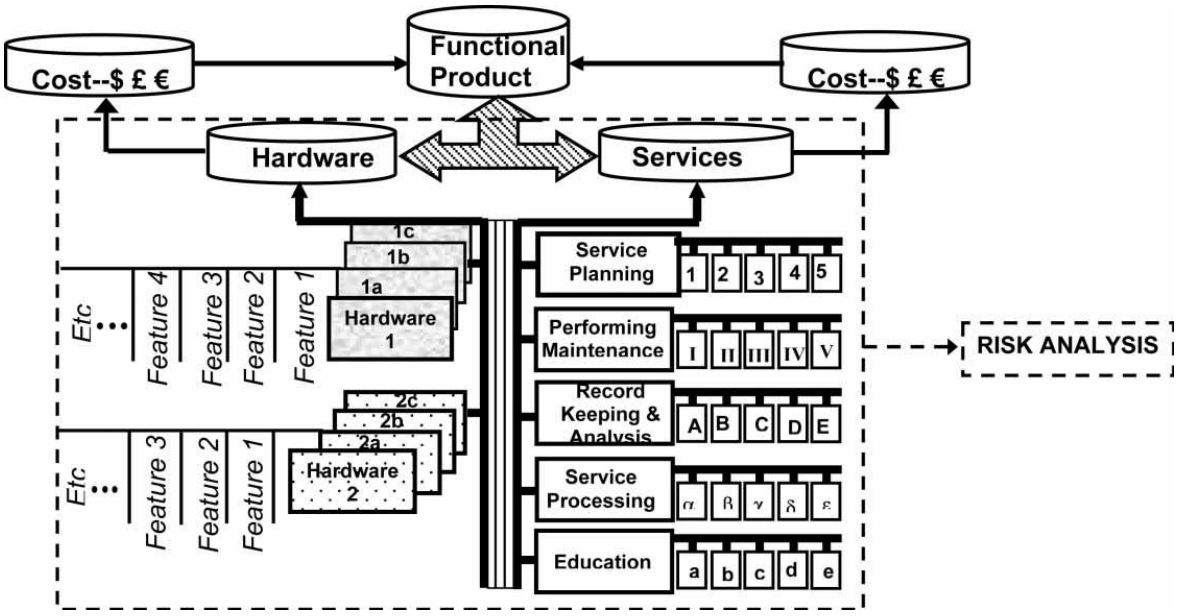



**Figure 24: Computational tool concept (Alonso-Rasgado and Thompson, 2006)**

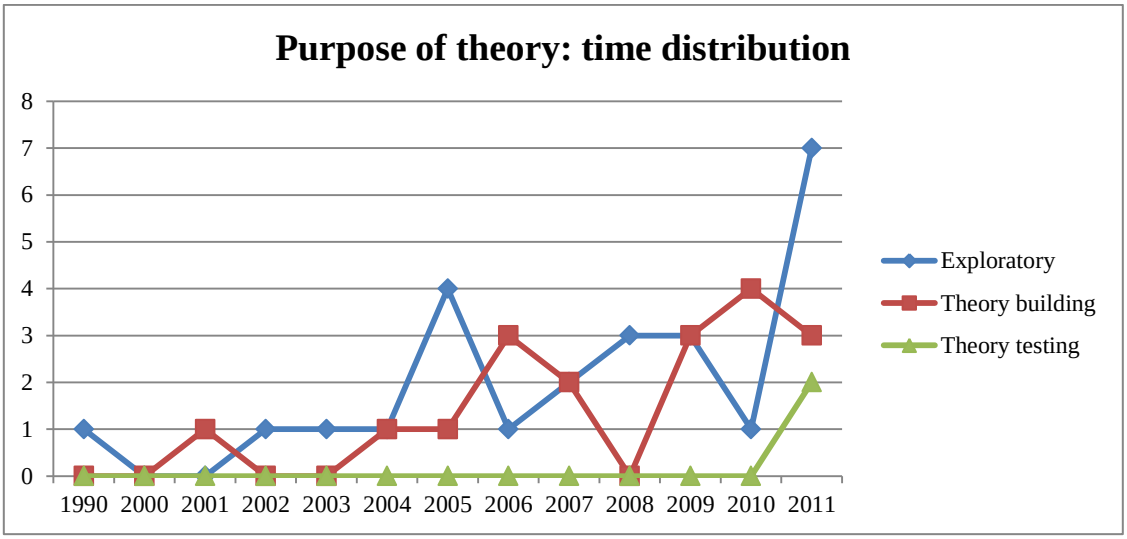
Still in the design area, Sandberg et al. (2005) introduce a method describing how to create a design support application that can simulate life-cycle costs in early phases, while Brohman et al. (2009) develop a framework for designing Network-based Customer Service System (NCSS), defined as the information system that deliver service to a customer, either directly or indirectly. Grounded in the design-science perspective, the study leverages marketing theory on Service Dominant Logic and the evolution of customer service systems.

*Purpose of theory*

Coherently with the time distribution of the articles, the papers mainly refer to the exploratory (55%) and theory building (41%) phases of theory development, demonstrating that theory development so far has been at a relatively simple and unsophisticated level. Conversely, the relative lack of emphasis on contributions such as theory testing and refinement shows that the field is still in an early stage, as remarked also in Graph 16.

| **Purpose** | **# of articles** | **% of articles** | **Articles reference numbers** |
|---|---|---|---|
| Exploratory | 25 | 56% | [7][39][40][42][44][63][84][136][138][140][144] [145][151][162][191][230][258][261][270][272] [274][282][303][313][317] |
| Theory building | 18 | 40% | [6][17][38][48][64][65][66][133][153][154][193] [262][278][280][293][299][324][325] |
| Theory testing | 2 | 4% | [52][166] |
| Theory refinement | 0 | 0% | - |

**Table 51: Group 4 - Distribution of publications in accordance with the purpose of theory**




**Graph 16: Group 4 – Time distribution of the purpose of theory**

*4. Research methodological issues*

*Research and data collection methods*

Results of classifying the articles according to research methods adopted are shown in Table 52.

| Method | # of articles | % of articles | Articles reference numbers |
|---|---|---|---|
| *Analytical* | *14* | *31%* | |
| Conceptual | 14 | 31% | [6][7][44][48][84][133][145][151][191][262][272][274][303][313] |
| | | | |
| *Empirical* | *31* | *69%* | |
| Case based | 21 | 49% | [17][40][42][63][64][65][66][136][138][140][153][154][162][193][230][261][278][282][317][324] [325] |
| Interviews | 6 | 11% | [38][39][270][280][293][299] |
| Survey | 4 | 9% | [52][144][166][258] |
| Total | 45 | 100% | |

**Table 52: Group 4 – Methodological classification**

As can be seen, most of the articles were classified as analytical conceptual (31%), based on literature and/or case examples, and empirical case studies (49%), more suitable for exploratory and theory building purpose (Yin, 1994).

### 2.4.2 Connecting the dots

Several conceptualisations to describe and systematise the nature of value creation by integrating services and physical goods have been proposed, investigating the topic from different perspectives and point of views. In some cases, the preference to use a specific term by researchers can be attributed to the fact that they come from different geographies or different disciplines.

After a deep descriptive analysis of each group of papers, it is possible to answer to the research questions formulated at the beginning of the systematic review process, as reported in Table 4 and Table 5.

I. How is the *servitization* phenomenon addressed in literature?

a. What are the main concepts, definitions and models developed?

b. What are the methodological approaches employed?

In order to answer to the first question, the first group of publications was analysed and the main findings are reported, as follows:

- The term *servitization* was introduced for the first time in 1988, with an explosion of publications in the last 3 years (37 out of 45);
- and represents the *evolutionary phenomenon from a product-centric perspective towards a product-service orientation, based on the provision of integrated bundles consisting of both physical goods and services*.
- almost half of the papers refer to Strategy/Management (challenges, strategic trajectories, impact on business models, etc.), followed by Supply Chain Management (impact on the supply chain and the relations with partner and suppliers), Design and Engineering (how to design properly these new solutions),

Marketing (relations with customers) and Operations Management (configure internal production and service operations);

– mainly from UK and manufacturing sector;
– 2/3 empirical research, mostly based on exploratory case studies.

The second research questions was addressed through the analysis of Group 2, 3 and 4. In particular:

II. What are the research fields that refer to the *servitization* phenomenon?

a. What are the main concepts, definitions and models developed?

b. What are the methodological approaches employed?

Group 2

– The term PSS appeared for the first time in 2000. Increasing interest in the topic since then;
– the main journals are Journal of Cleaner Production (17%), CIRP Journal of Manufacturing Science and Technology (9%), International Journal of Advanced Manufacturing Technology (9%) and Journal of Manufacturing Technology Management (9%), related to the sustainability and the manufacturing field;
– the most prolific authors are R. Roy, T. Sakao and O.K. Mont ("mother" of the field, who clarified the concept of PSS and identified its elements);
– mainly related to design/engineering (theory building: methodology for PSS design and development) and strategy/management (exploratory: barriers and challenges, general description of new business models, state of the art in specific sectors) disciplines;
– even if the general field of PSS grew out of a history of sustainability research, during the last years the attention towards such aspect has dropped;
– PSS is a *sustainable business model, characterised by an integrated product-service offering*.

Group 3

- The term Service Dominant Logic (SDL) was used for the first time in 2004 by Vargo and Lusch;
- who are also the reference authors for this research stream and who conceptualised the ten foundational premises of SDL;
- it represents a *new way to create value, based on service as a fundamental basis of exchange*;
- the publications are strongly related to the USA (34%) and UK (13%);
- and to the marketing discipline (76%);
- as also shown by the main journals where the papers are published: Journal of the Academy of Marketing Science (11%) , Marketing theory (9%) and Industrial Marketing Management (7%);
- methodologically, the field is still under exploration (62%) through conceptual analysis (67%).

Group 4

- The papers mainly refer to solutions (customer and integrated);
- defined as *customised and integrated combinations of product and services offered to provide outcomes and functionalities desired by the customers*;
- it is a new field, essentially European (in particular UK, with the 29% of the papers, and Germany with the 15%), related to manufacturing sectors (56%);
- and to strategy and management disciplines (52%);
- authors come from both business and engineering departments;
- the research is still at an early stage, mostly approached through conceptual and empirical case-based methods.

The third question refers to the commonalities that the four groups present.

III. How are these fields connected to the *servitization* research stream?

As extensively discussed in this Chapter, the different fields refer to the same empirical phenomenon: the evolution of a company, from manufacturer to product-service provider. However these areas are characterised by different perspectives and foci of investigation. Trying to summarise the developed concepts and definitions in a single statement, it could be argue that:

> ***Servitization*** is the evolutionary phenomenon of the business model of a manufacturing company, moving from a product-centric perspective towards ***Product-Service Systems (PSSs)***, based on the provision of ***integrated bundles consisting of both physical goods and services***, coherently with a ***service-dominant logic*** of value creation.

Even if it is clear that these four sub-fields are strongly conceptually interconnected, the different schools of thought, related to different disciplines and geographical origins, seem to work in autonomous silos (*multidisciplinarity* approach).

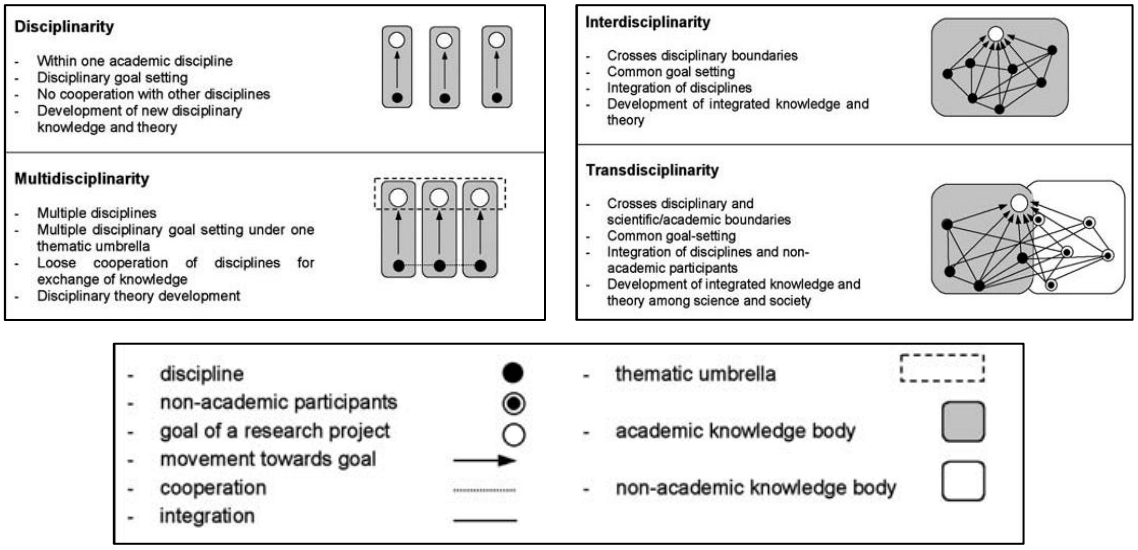



**Figure 25: Overview of disciplinarity, multidisciplinarity, interdisciplinarity and transdisciplinarity (Tress et al., 2005)**

Instead, a transdisciplinary approach is needed, where field boundaries are crossed by researchers in order to create new knowledge and theory and achieve a common goal. In addition, non-academic participants, such as land managers, user-groups and the general

public, should be involved, in order to strength the experiential foundations of the research.

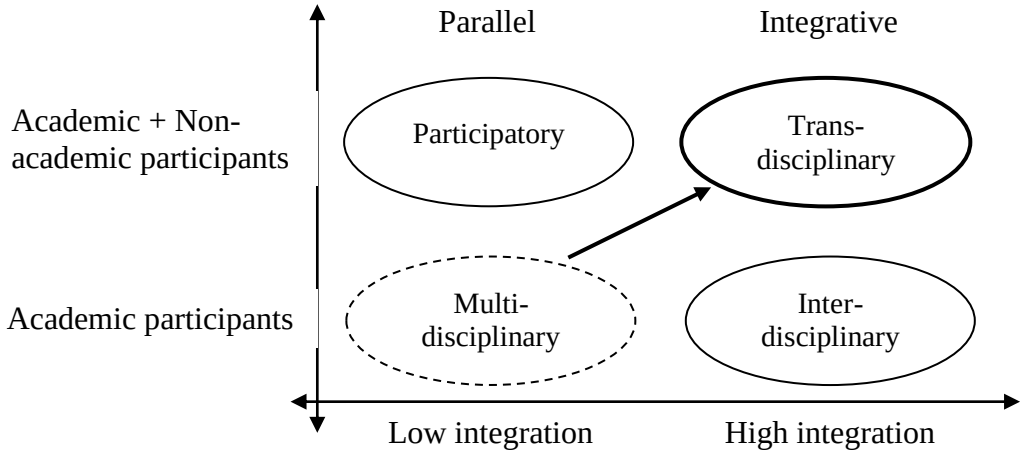



**Figure 26: From a multidisciplinary to a transdisciplinary approach (adapted from Tress et al., 2005)**

Finally, notwithstanding the importance and timeliness of the subject, scholarly research is still at an early stage. As a consequence, a systematic academic inquiry on the transition from product offerings to product-service offerings is necessary, especially through empirical investigations.

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# 3 Developing the research conceptual model and questions: the Sustainable PSS Business Model

As highlighted in the Introduction, changes of the competitive landscape are driving manufacturing companies (*who* - Figure 27) to find additional profit centres in the service domain (*why* - Figure 27), expanding their traditional offerings to the provision of customer-focused "bundles", consisting of products and services. However, this evolutionary phenomenon called servitization is not merely related to the introduction of new services in the company's portfolio, or the proposal of integrated solutions. It is the evolution of the entire business model of a manufacturing firm (*what* - Figure 27), including its value proposition, its position and role in the value creation network, its capabilities and organisational structure, and its relations with the customers. In order to understand *how* (Figure 27) this evolutionary transformation occurs, it is fundamental to understand better *what* evolves: the way a manufacturing firm creates value. Aim of this chapter is to develop the conceptual model underlying the research, representing *what* is the object of such evolution: a Sustainable PSS Business Model.

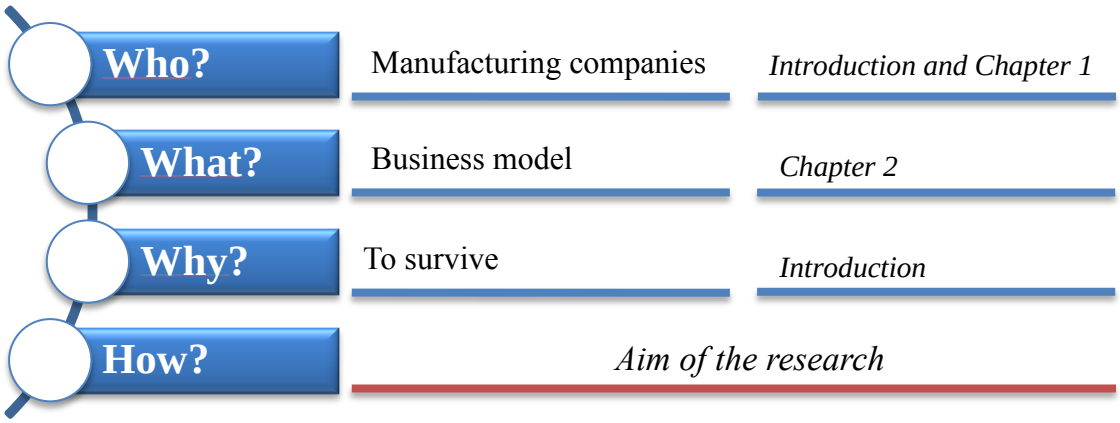


**Figure 27: Research overview: Who? What? Why? How?**

## 3.1 What is a conceptual model

In theory building research, no matter how inductive the approach, a prior view of the general constructs or categories and their relationships is valuable in order to: i) shape the initial research design, ii) measure constructs more accurately, and iii) have a firmer empirical grounding for the emergent theory (Voss et al., 2002). As suggested by Miles and Huberman (1994), this can be done through the construction of a conceptual model that underlies the research. Such a model explains, either graphically or in a narrative form, the main aspects that have to be studied and the presumed relationships amongst them. Compared to conceptual frameworks, a conceptual model is used to represent or describe a phenomenon, but not to explain it (Meredith, 1993). As represented in Figure 28, the model is structured in two parts (Edwards and Bagozzi, 2000): i) the measurement model, related to the definition of the constructs and the relative variables characterising a Sustainable PSS Business Model, ii) the structural model, that places attention on explaining causal relationships among constructs, defining their nature and direction. Any propositions identified in the model are merely logical statement rather than epistemological relationships (Lin, 1976). On the contrary, conceptual frameworks are characterised by an explanatory power.

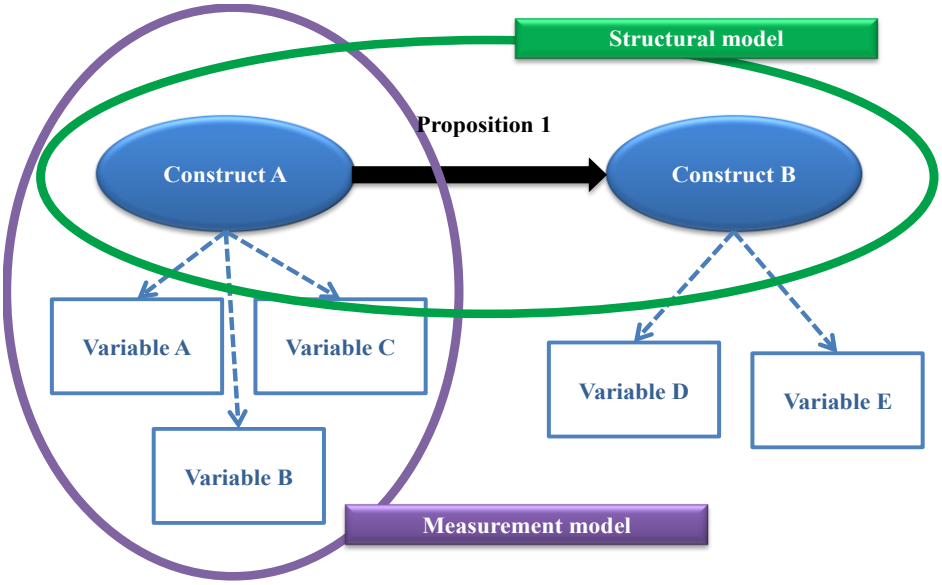


**Figure 28: Building the conceptual model**

Since this research work is focused on PSS as a sustainable and servitized business model, in the next section the business model concept is briefly introduced and described as a first step towards the development of the conceptual research model.

## 3.2 What is a Business Model

In the most basic sense, a business model is the method of doing business by which a company can generate profit. It spells out how a company makes money or gets paid (Chesbrough and Rosenbloom, 2002), by specifying how it intends to create value (Linder and Cantrell, 2000). Literature definitions about the concept underlying a business model are various and heterogeneous. The term is used for a broad range of informal and formal descriptions, and the existing definitions diverge in terms of content, structure and perspective (Magretta, 2002). The research conceptual model at the base of this doctoral research is built on the business model structure presented by Osterwalder and Pigneur (2010). This particular model was chosen since it is the most popular business models specification framework and, additionally, it is based on a rigorous research process undertaken over the last decade, also applied and tested in many organizations (Osterwalder and Pigneur, 2002; Osterwalder, 2004; Osterwalder et al., 2005; Fritscher and Pigneur, 2010). The model, call Business Model Canvas, acts as a tool that contains the main elements of a business model and that can be used to describe, analyse and design business models. It is composed by nine building blocks, as depicted in Figure 29:

1. *Customer segments*, defines the different groups of people or organizations an enterprise aims to reach and serve;
2. *Value propositions*, describes the bundle of products and services that create value for a specific Customer Segment;
3. *Channels*, describes how a company communicates with and reaches its Customer Segments to deliver a Value Proposition;
4. *Customer Relationships*, describes the types of relationships a company establishes with specific Customer Segments;
5. *Revenue Streams*, represents the cash a company generates from each Customer Segment (costs must be subtracted from revenues to create earnings);
6. *Key Resources*, describes the most important assets required to make a business model work;
7. *Key Activities*, describes the most important things a company must do to make its business model work;

8. *Key Partnerships*, describes the network of suppliers and partners that make the business model work;
9. *Cost Structure*, describes all costs incurred to operate a business model.

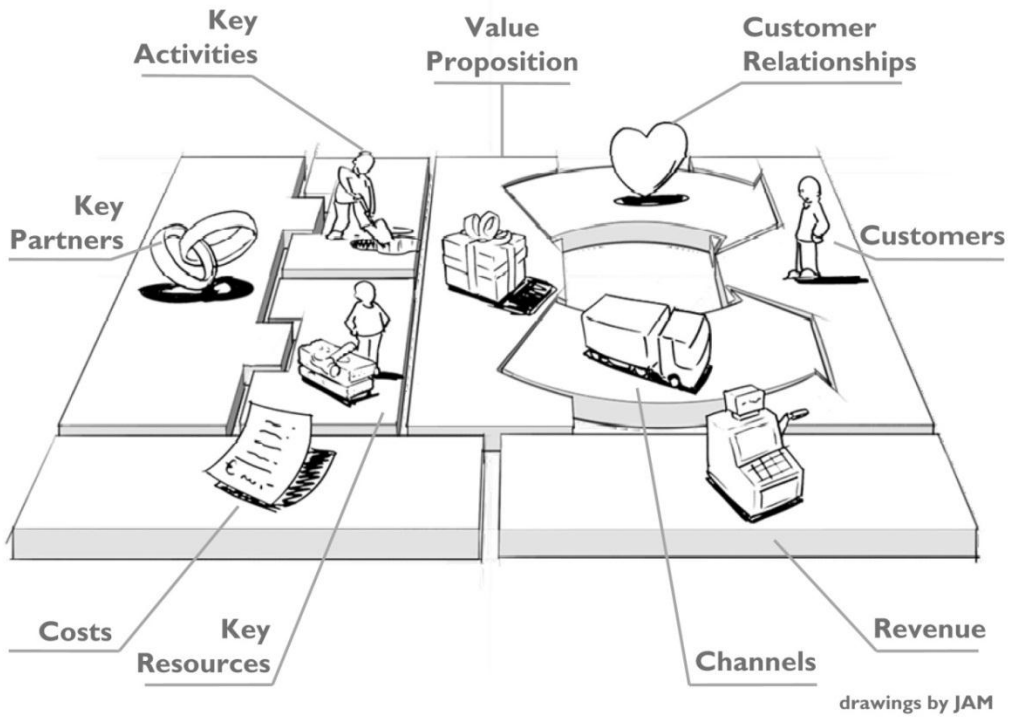


**Figure 29: The Business Model Canvas - the nine building blocks (Osterwalder and Pigneur, 2010)**

This tool, that illustrates and collects the diversified and essential elements at the architectural level of business, has then been used as a starting point to develop the conceptual model underlying the research. It has been tailored specifically to fit the servitization debate, not only describing its constituent elements and the related variables (Paragraph 3.3.1), but also assuming the relationships between them (Paragraph 3.3). The strength of adopting a business model approach in managing the servitization journey is that it puts attention on how the elements of the system fit into a structured and consistent whole (Magretta, 2002).

## 3.3 Creating a sustainable PSS Business Model

Most business model conceptualisations build on value creation for the customer (Chesbrough and Rosenbloom, 2002; Morris et al., 2005; Magretta, 2002). However,

since a PSS is a business model that describes how a servitized company creates sustainable value, conventional business model perspectives should be extended to consider not only the value created for the customers, but for all the stakeholders (Mont, 2002; Tencati et al., 2004; Morelli, 2006), in accordance with the three pillars of sustainability: Economy, Environment and Society (Elkington, 1994; Tischner, et al., 2009). As a consequence, the "Value proposition" dimension of the Osterwalder and Pigneur's Business Model Canvas could be split into four different types of value, in accordance with different groups of stakeholders:

- Customer Value Proposition, representing the value created for the customers through an integrated offering of products (or hardware) and services (Vandermerwe and Rada, 1988; Mont, 2002; Alonso-Rasgado et al., 2004; Brady et al., 2003; Brax and Jonsson, 2009; Pawar et al., 2009; Schuh et al., 2008; Davies et al., 2006);
- Economic Value Proposition, that represents the competitiveness of the business on the market and its economic profitability (Dyllick and Hockerts, 2002). It refers to the value created for the shareholders and is comparable to the Revenue Streams and Cost Structure of the Business Model Canvas;
- Environmental Value Proposition, describes the value created for the environment and impact of firm's activities on natural systems, including ecosystems, land, air, and water (Dyllick and Hockerts, 2002);
- Social Value Proposition, concerns the value an organization creates for the social systems within which it operates (Dyllick and Hockerts, 2002).

Afterwards, the remaining six dimensions have been grouped into two main groups:

- Relationship capital, including the areas that refers to the customer (Segments, Channels and Relationships);
- Infrastructure and Network, that refers to organizational structure, activities, partners, resources, capabilities and competences involved in the creation of value.

As depicted in Figure 30, each group represents a construct of the research conceptual model under development.

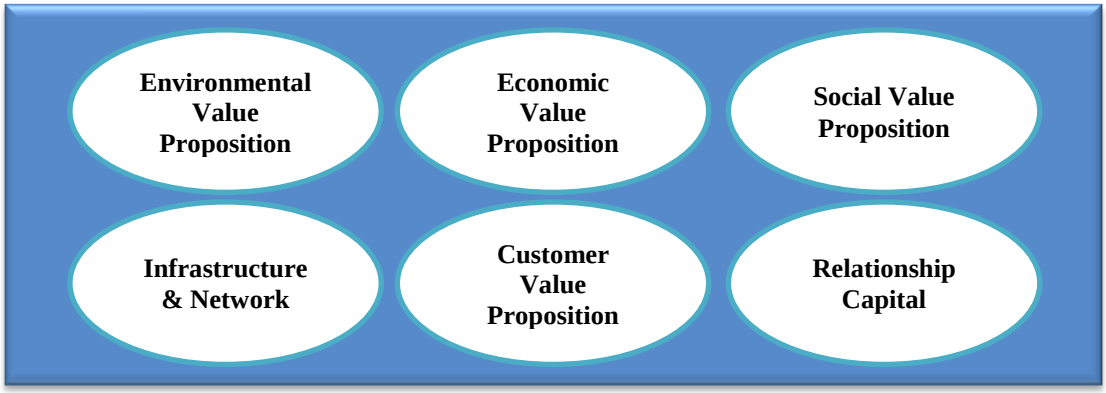


**Figure 30: A sustainable PSS Business Model: Theoretical constructs**

However, since the variables of theoretical interest are often latent in nature and not directly observable, their measurement can only occur indirectly by means of observable variables (Byrne, 1994), outlined in the next paragraph.

### 3.3.1 The measurement model

A literature review based on *servitization* and PSS, crossed with Corporate Sustainability and Business Model literature, has been performed. The many variables used in past research have been related to the theoretical constructs constituting the Sustainable PSS Business Model.

#### *3.3.1.1 The Customer Value Proposition*

Also referred as PS offering, the Customer Value Proposition consists of integrated bundles of products and services. Many classifications have been proposed in literature to describe the varying degrees of product-service integration (Alonso-Rasgado and Thompson, 2006; Aurich et al., 2010; Bartolomeo et al., 2002; Fan and Zhang, 2009; Frambach et al., 1997; Gao et al., 2009; Kujala et al., 2010; Manzini and Vezzoli, 2003; Markeset and Kumar, 2005; Mathieu, 2001a; Matthyssens and Vandenbempt, 2010; Oliva and Kallenberg, 2003; Penttinen and Palmer, 2007; Salonen, 2011; Tukker, 2004; Windahl and Lakemond, 2010), based on different dimensions. For instance Mathieu (2001a) introduces two different forms of PS offering: services supporting the supplier product and services supporting the client action. The direct recipient of the service is a product, in the first case, and a person, in the second one. Moreover the services supporting the supplier's product are characterized by standardized solutions, a low intensity of relationship between the parties involved, and the predominant variables of

the expanded marketing mix are the physical evidence. The second form of PS offering refers to highly customised solutions requiring an high degree of involvement and commitment of both customers and providers, where the predominant variables of the expanded marketing mix are people. Product ownership, use and decision making power are the dimensions considered by Manzini and Vezzoli (2003) in defining three types of PS offerings: services providing added value to product life cycle, services final result to customer and services providing enabling platforms for customers. The same dimensions are reported in Tukker's work (2004), where eight PSS archetypical models are introduced and categorised in three main groups (product-, use- and result-oriented services). The ownership and use aspects, together with the involvement in customer's process are also considered by Bartolomeo et al. (2002) to cluster PS offering into two main areas, product-based services including, product-result, pooling, utility and extension services, and information-based services including advice and consultancy, information and intermediation activities. Also Gao et al. (2009) frame the PS offering into three main groups, product-, application- and utility-oriented PSS, along two dimension: product ownership and product use. Fan and Zhang (2009) extend Gao et al.'s categorization by introducing a new dimension related to the Supply Chain vertical integration and to the level of control of distribution system, already introduced by Wise and Baugartner in 1999. Finally, in Oliva and Kallenberg (2003) who categorise how firms can position themselves in the transition from selling products to selling services, PS offering is classified using a two-dimensional orthogonal criteria. The first dimension distinguishes the product-service offering in product-oriented services and user's processes-oriented ones. The second one, according to the classification proposed by Frambach et al. (1997), allows classifying the product-service offering according to the nature of the customer interaction from selling products (transaction-based) to establishing and maintaining a closer relationship with the customer (relationship-based). This characteristic is especially stressed by the literature on integrated-customer solution (Group 4 in Chapter 1). Table 53 summarises the main variables considered in literature to describe the PS offerings.

| Dimension | Alonso-Rasgado and Thompson, 2006 | Aurich et al., 2010 | Bartolomeo et al., 2002 | Fan and Zhang, 2009 | Frambach et al., 1997 | Gao et al., 2009 | Kujala et al., 2010 | Manzini and Vezzoli, 2003 | Markeset and Kumar, 2005 | Mathieu, 2001a | Matthyssens and Vandenbempt, 2010 | Oliva and Kallenberg, 2003 | Penttinen and Palmer, 2007 | Salonen, 2011 | Stremersch et al., 2001 | Tukker, 2004 | Windahl and Lakemond, 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PS Offering Focus | | | | | | | X | | X | X | X | X | X | X | | | X |
| Product Ownership | X | X | X | X | | X | | X | X | | | | | | | X | X |
| Product Use | | | X | X | | X | | X | | | | | | | | X | |
| Product Decision Making Power | | | | | | | | X | | | | | | | | X | |
| Involvement and Relationship Intensity | | | X | | | | | | | X | | | | | | | |
| Supply Chain Vertical Integration | | | | X | | | | | | | | | | | | | |
| Nature of Interaction | | | | | X | | X | | | | | X | X | | | | |
| Bundling Strategy | | | | | | | | | | | | | | | X | | |

**Table 53: Main variables of the PS offering – literature analysis**

Four variables have been considered to describe the Customer Value Proposition:

- *Product ownership* (Customer vs. PS Provider);
- *Product use* (Customer vs. PS Provider);
- *Decision Making Power* on product use and management (Customer vs. PS Provider);
- *PS Offering Focus*, that moves from ensuring the availability and functionality of the product to supporting the end-users' processes and activities, up to managing internal functions or business units.

The variables Involvement and Relationship Intensity (Bartolomeo et al., 2002; Mathieu, 2001a) and Nature of Interaction (Frambach et al., 1997; Oliva and Kallenberg, 2003), representing the interaction between the customer and the PS

provider, will be considered in the Relationship Capital construct. The variable Supply Chain Vertical Integration (Fan and Zhang, 2009) will be discussed in the Infrastructure and Network construct. The variable Bundling Strategy (Stremersch et al., 2001) has not been considered relevant since it has been used in only one paper.

Afterwards, the identified variables have been used to characterised the three main PSS groups proposed by Tukker (2004): product-, use- and result-oriented, as presented in Table 54.

| | **Variables** | | | |
|---|---|---|---|---|
| **Types** | **Product Ownership** | **Product User** | **Product Decision Maker** | **PS Offering Focus** |
| Product-oriented | Customer | Customer | Customer | Product<br>Process/Business |
| Use-oriented | PS provider | Customer | Customer | Process/Business |
| Result-oriented | PS provider | PS provider<br>Customer | Customer<br>PS provider | Process/Business |

**Table 54: Main variables and types of the Customer Value Proposition**

These PS offering types can be positioned along the so call "product-service continuum" (Oliva and Kallenberg, 2003), characterised by an increasing *servitization* level of the Customer Value Proposition.

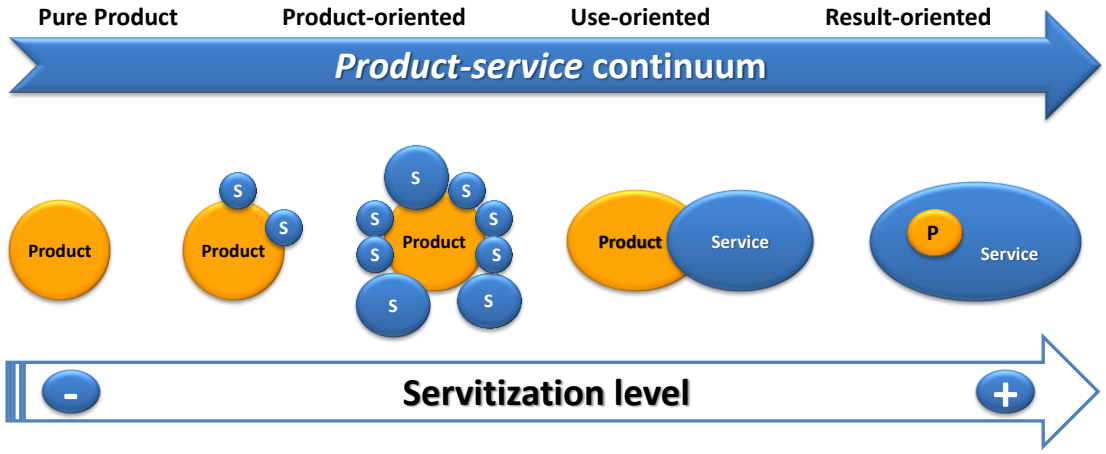


**Figure 31: The product-service continuum and the increasing servitization level**

#### *3.3.1.2 The Economic Value Proposition*

"Economically sustainable companies guarantee at any time cash flow sufficient to ensure liquidity while producing a persistent above average return to their shareholders" (Dyllick and Hockerts, 2002). Traditionally, the economic and financial performance of a firm is related to short term profitability (GRI, 2011; Maxwell et al., 2006; Mont, 2004), depending on *revenue* (Alonso-Rasgado and Thompson, 2006; Oliva and Kallenberg, 2003; Bonnemeier et al., 2010; Sharma and Iyer, 2011; De Coster, 2010; Kujala et al., 2010; Markeset and Kumar, 2005; Matthyssens and Vandenbempt, 2010; Schuh et al., 2008) *and cost structure* (Maxwell et al., 2006; Vogtländer et al., 2002), and its own sustainability in the long period, such as *market presence* (GRI, 2011; Maxwell et al., 2006; Mont, 2004) and *competitive advantage* (Maxwell et al., 2006; Mont, 2004).

| **Dimension** | Alonso-Rasgado and Thompson, 2006 | Bonnemeier et al., 2010 | De Coster, 2010 | GRI, 2011 | Kujala et al., 2010 | Markeset and Kumar, 2005 | Matthyssens and Vandenbempt, 2010 | Maxwell et al., 2006 | Mont, 2004 | Oliva and Kallenberg, 2003 | Sharma and Iyer, 2011 | Schuh et al., 2008 | Vogtländer et al., 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Revenue/Profit Structure | X | X | X | | X | X | X | | | X | X | X | |
| Cost structure | | | | | | | | X | | | | | X |
| Economic Performance | | | | X | | | | X | X | | | | |
| Market Presence | | | | X | | | | X | X | | | | |
| Competitive advantage | | | | | | | | X | X | | | | |

**Table 55: Main variables of the Economic Value Proposition - literature analysis**

#### *3.3.1.3 The Environmental Value Proposition*

"Ecologically sustainable companies use only natural resources that are consumed at a rate below the natural reproduction, or at a rate below the development of substitutes. They do not cause emissions that accumulate in the environment at a rate beyond the capacity of the natural system to absorb and assimilate these emissions" (Dyllick and Hockerts, 2002). Basically, environmental indicators are related to inputs (e.g., material, energy, water) and outputs (e.g., emissions, effluents, waste), and can be ascribed to the most used variables:

- *Material use* (Evans et al., 2007; Figge et al., 2002; Firnkorn and Müller, 2011; GRI, 2011; Halme, 2004; Lelah et al., 2011; Maxwell, et al. 2006; Partidàrio et al., 2007; Verfaillie and Bidwell, 2000)*;*
- *Energy consumption* (Evans et al., 2007; Figge et al., 2002; Firnkorn and Müller, 2011; GRI, 2011; Halme, 2004; Lelah et al., 2011; Manzini and Vezzoli, 2003; Maxwell, et al. 2006; Partidàrio et al., 2007; Verfaillie and Bidwell, 2000);
- *Water consumption* (Evans et al., 2007; Firnkorn and Müller, 2011; GRI, 2011; Halme, 2004; Lelah et al., 2011; Partidàrio et al., 2007; Verfaillie and Bidwell, 2000);
- *Waste generation* (Evans et al., 2007; Figge et al., 2002; Firnkorn and Müller, 2011; Halme, 2004; Lelah et al., 2011; Maxwell, et al. 2006; Partidàrio et al., 2007);*;*
- *Emissions of pollutants to air, soil and water* (Evans et al., 2007; Figge et al., 2002; Firnkorn and Müller, 2011; GRI, 2011; Halme, 2004; Lelah et al., 2011; Manzini and Vezzoli, 2003; Maxwell, et al. 2006; Partidàrio et al., 2007; Verfaillie and Bidwell, 2000).

| Dimension | Evans et al., 2007 | Figge et al., 2002 | Firnkorn and Müller, 2011 | GRI, 2011 | Halme, 2004 | Lelah et al., 2011 | Manzini and Vezzoli, 2003 | Maxwell, et al. 2006 | Partidàrio et al., 2007 | Verfaillie and Bidwell, 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Material use | X | X | X | X | X | X | | X | X | X |
| Energy consumption | X | X | X | X | X | X | X | X | X | X |
| Water consumption | X | | X | X | X | X | | | X | X |
| Waste generation | X | X | X | | X | X | | X | X | |
| Emissions of pollutants to air, soil and water | X | X | X | X | | X | X | X | X | X |
| Noise and vibrations | | X | | | | | | | | |
| Transports | X | | | | X | | | | X | |

**Table 56: Main variables of the Environmental Value Proposition - literature analysis**

#### *3.3.1.4 The Social Value Proposition*

"Socially sustainable companies add value to the communities within which they operate by increasing the human capital of individual partners as well as furthering the societal capital of these communities. They manage social capital in such a way that stakeholders can understand its motivations and can broadly agree with the company's value system" (Dyllick and Hockerts, 2002). Basically, the social aspects related to sustainability consists in ensuring the existence and success of the enterprise while at the same time taking account of the diversity of social, cultural and individual social demands (Schaltegger and Burritt, 2005). This is related to protect the social acceptance of the firm and the legitimation of its business activities in terms of *employee equity and satisfaction, human rights* and *health, safety and security*. As demonstrated by the paucity of the references reported in the following table, social sustainability is often neglected.

| Dimension | Figge et al., 2002 | GRI, 2011 | Halme, 2004 | Maxwell, et al. 2006 |
|---|---|---|---|---|
| Employee equity and satisfaction | X | X | | X |
| Human rights | | X | | X |
| Health, safety and security | | X | X | X |

**Table 57: Main variables of the Social Value Proposition - literature analysis**

#### *3.3.1.5 The Infrastructure and Network*

Based on the configuration of the Customer Value Proposition, this construct describes the required competences, resources and skills and the related "make-or-buy" decisions (Schuh et al., 2008). Moreover, partner contributions are determined and coordination mechanisms as well as communication channels are installed among the partners of the PS Value Network (Lusch et al., 2010). The latter is responsible for design, manage and delivery the PS offering and comprises not only the partners necessary for the production of the physical products, but also the actors responsible for delivering service components (Schweitzer et al., 2009). This includes:

- *PS Provider*, positioned in the focal point of the network, is the manufacturing company that creates the offer to the customers and organises all aspects of the PS offering in the value network;
- suppliers of parts, components, modules or systems that represent the members of the *Product Network*;
- suppliers of services, representing the *Service Network*
- branches and service locations of the manufacturer, as well as independent distribution and service partners, for the *PS Provision Network*.

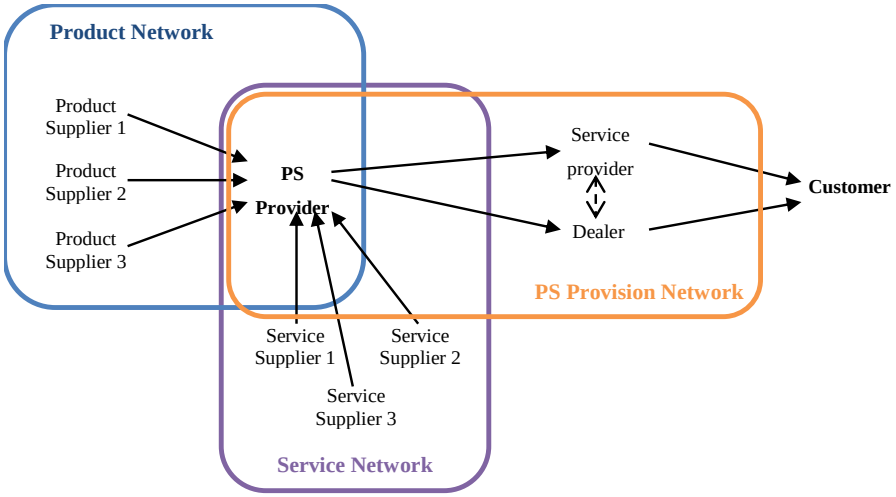


**Figure 32: The PS Value Network (adapted from Schweitzer et al., 2009)**

The many aspects found in literature are proposed in Table 58.

| Dimension | Aurich et al., 2010 | Brady et al., 2005 | Ceci and Masini, 2011 | Cook et al., 2006 | Davies and Brady, 2000 | Evans et al., 2007 | Gebauer et al., 2005 | Johnson and Mena, 2008 | Johnstone et al., 2009 | Kujala et al., 2010 | Leiringer et al., 2009 | Li, 2011 | Löfberg et al., 2010 | Madhavaram and Hunt, 2008 | Matthyssens and Vandenbempt, 2010 | Miller et al., 2002 | Mont, 2004 | Neu and Brown, 2008 | Partidàrio et al., 2007 | Pawar et al., 2009 | Salonen, 2011 | Storbacka, 2011 | Tuli et al., 2007 | Vargo and Lusch, 2008 | Windahl and Lakemond, 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Competences | | X | X | X | X | | | | | X | X | X | | | X | X | | X | | X | X | X | | X | |
| Asset and Resources | | | | | | | | | | | | | X | X | | | | X | | | X | | | X | |
| Value Network Configuration | X | | | X | | | | | | X | | | | | X | | X | | | | | | | X | X |
| 1. PS Provider | | | | | X | | X | | X | | X | | X | | | X | | X | | | | X | X | | |
| 2. Product Network | | | | | | X | | X | | | | | | | | | | | X | X | | | | | |
| 3. Service Network | | | | | | X | | X | | | | | | | | | | | X | X | | | | | |
| 4. PS Provision Network | | | | | | X | | X | | | | | | | | | | | X | X | | | | | |

**Table 58: Main variables of the Infrastructure and Network - literature analysis**

Summarising the information reported in Table 58, the variables that describe the Infrastructure and Network construct are:

- *Assets and Resources*, describing the resources, owned or controlled by the PS provider, involved in the value creation. They are both tangible and intangible assets that enable the firm to produce a PS offering and can be categorised as financial, physical, legal, human, organizational, informational, and relational (Hunt, 2000);
- *Competences*, representing skills and capabilities required for creating and providing PS offering to the customers;
- *Value Network Configuration* representing both activities, processes and internal relationships among business functions of the PS provider, and the interaction of the PS provider with other actors in the Value Network.

#### *3.3.1.6 The Relationship Capital*

The relationship between the company and its customers plays a key role in PSS design, implementation and provision. In fact, evolved PSSs are characterised by a strong customer-centricity (Galbraith, 2002) and by customer-focused integrated PS offerings (Vandermerwe and Rada, 1988; Mont 2002; Davies et al., 2006), as highlighted also by the several definitions of PSS, Integrated Solutions and Servitization presented in Chapter 1. Moreover, the customer involvement in developing, producing and delivery the service is a consolidated concept in the Service Dominant Logic, where value co-creation is a higher-ranking construct comprising both the "co-creation of value" and "co-production" as subcategories (Le Meunier-FitzHugh et al., 2011). In particular, the idea of co-creation is closely related to the consumption process and to the "value-in-use" paradigm, and is fundamentally relational, while "co-production" involves the participation of the customer in the creation of the core offering itself (Lusch et al., 2007). It is important then to consider the interaction between the customer and the PS provider both in the provision (co-creation) phase, ranging from a transaction-based to a relationship-based perspective(Oliva and Kallenberg, 2003; Frambach et al., 1997; Lusch et al., 2007; Moeller, 2008; Penttinen and Palmer, 2007; Windahl and Lakemond, 2010), and the design and development phases (co-production) (Alonso-Rasgado et al., 2004; Alonso-Rasgado and Thompson, 2006). The PS offering is delivered to the

selected customer segments (Parry et al., 2011; Hirschl et al., 2003) through a channel (Aurich et al., 2010; Markeset and Kumar, 2005; Paulin and Ferguson, 2010, Sharma and Iyer, 2011).

Considering the characteristics found in literature (Table 59), four variables can be considered to describe this construct:

- *Market segment*, that refers to the division of the market into distinct groups, having different needs, wants and behaviours;
- *Channel strategy*, that represents the link between production and consumption ;
- *Relationship dynamics*, that is related to the nature of the customer/PS provider interaction in the PS provision phase, moving from a transactional to a relationship-based perspective;
- *Customer integration*, defines the degree of customer participation in the product/service design and development.

| **Dimension** | Alonso-Rasgado and Thompson, 2006 | Alonso-Rasgado et al., 2004 | Aurich et al., 2010 | Frambach et al., 1997 | Hirschl et al., 2003 | Le Meunier-FitzHugh et al., 2011 | Lusch et al., 2007 | Markeset and Kumar, 2005 | Moeller, 2008 | Oliva and Kallenberg, 2003 | Parry et al., 2011 | Paulin and Ferguson, 2010 | Penttinen and Palmer, 2007 | Sharma and Iyer, 2011 | Windahl and Lakemond, 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Market segment | | | | | X | | | | | X | X | | | | |
| Channel strategy | | | X | | | | | X | | | | X | | X | |
| Relationship dynamics | X | X | | X | | X | X | | X | X | | | X | | X |
| Customer integration | X | X | | | | X | X | | X | | | | | | |

**Table 59: Main variables of the Relationship Capital - literature analysis**

### 3.3.2 The structural model

Once built the measurement model, it is possible to hypothesise the relationships among the different constructs of a Sustainable PSS Business Model, defining their nature and direction. Therefore five presumed relationships have been developed from literature in order to assess how the different constructs affect each other.

The Customer Value Proposition is the central pillar of the Sustainable PSS Business Model since the integrated PS offering represents its distinctive feature from other business models. For example, the "e-commerce" business model is characterised by commercial transactions conducted over Internet (Channel variable of the Relationship Capital construct) (Mahadevan, 2000), while for the "razor-razor blade model" the revenue model (Pricing Structure of the Relationship Capital construct) involves pricing razors inexpensively, but aggressively marking-up the consumables (razor blades) (Teece, 2010). On the contrary, a focus on PSS implies a shift away from selling a product to selling an offering of value that the customer derives from the integrated package of product and service (Pawar et al., 2009). Its central role is also remarked by the need to consider the identification of the product-service elements (or Customer Value Proposition) at the beginning of PSS design and development activities (van Halen et al., 2005; Morelli, 2003) and service innovation process (Shelton, 2009).

#### *3.3.2.1 The effect of Customer Value Proposition on Relationship Capital*

As previously noticed, one important characteristic of PSS is the nature of the relationship between the PS provider and the customer. Moving towards a more servitised value proposition, the interaction with customers shifts from a pure transaction of products to an intimate relationship (Oliva and Kallenberg, 2003; Vargo and Lusch, 2008; Mont, 2002; Vandermerwe, 1990; Matthyssens and Vandenbempt, 2010) where customer and provider design together the service (Alonso-Rasgado et al., 2004; Brax and Jonsson, 2009), supported by reciprocal trust. (Brady et al., 2005) Tackling a servitisation strategy pushes companies to expand their definition of the value chain, changing their focus on operational excellence to alliances with customers and rethinking the meaning of vertical integration (Wise and Baumgartner, 1999) and risk management (Oliva and Kallenberg, 2003; Alonso-Rasgado et al., 2004; Sawhney et al., 2004).

| Reference | Quote(s) |
|---|---|
| Alonso-Rasgado et al., 2004 | "Functional products are the substance of long-term business-to-business relationships. They are not bought and sold in the short term. In order to create an economically efficient functional product, the provider needs to be involved in an intimate business relationship with the customer. The provider will share the business risk with the customer and therefore needs to know much about the technological and business activities of the customer."<br>"Concept creation for service systems of functional products needs to be a continuously interactive process between the client and the provider".<br>"In the case of functional products, it is possible to explore ideas and concepts with the customer and so develop the customer awareness of business potential." |
| Brady et al., 2005 | "Integrated solutions transform the customer relationship. Supplier no longer respond passively to specifications set by their customers or assume that customer needs are set in stones. The emphasis is on a long-term relationship built on trust." |
| Brax and Jonsson, 2009 | "Integration needs to be addressed (at least) at two levels: in the basic level of the offering and the provider firm, and in the higher level between the solution subsystem and the external system of the client. By the term "systemic" we mean that the components of integrated solutions are interdependent, and integration refers to co-design and management of the different subsystems within the solution offering." |
| Matthyssens and Vandenbempt, 2010 | "A strong collaboration and integration with in the company but also with the customer is identified as a key issues (Brax and Jonsson, 2009)." |
| Mont, 2002 | "For consumers, PSSs mean a shift from buying products to buying services and system solutions that have a potential to minimise the environmental impacts of consumer needs and wants. This requires a higher level of customer involvement and education by producers." |
| Oliva and Kallenberg, 2003 | "The first transition is to change the focus of customer interactions from transaction- to relationship-based. Moving along this dimension (vertical axis of Table I) changes the way the service is priced: from a markup for labor and parts every time a service is provided, to a fixed price covering all services over an agreed period. The effect of this form of contracting is that the service provider assumes the risk of equipment failure." |
| Sawhney et al., 2004 | "The process of migration to services can be difficult and risky. To improve the chances of success, managers must |

| | |
|---|---|
| | be conscious of the risks involved […]. There are three major categories of risk: capability risk (the internal perspective), market risk (the customer perspective) and financial risk (the business model perspective)". |
| Vargo and Lusch, 2008 | "A service-centered view is inherently customer oriented and relational." |
| Vandermerwe, 1990 | "From buyer/seller to strategic relationships" |
| Wise and Baumgartner, 1999 | "To capture value downstream, manufacturers need to expand their definition of the value chain, shift their focus from operational excellence to customer allegiance, and rethink the meaning of vertical integration." |

**Table 60: The effect of Customer Value Proposition on Relationship Capital – quotes from literature**

***R1****: The servitisation level of the Customer Value Proposition is related to: i) the degree of customer integration within the value chain, ; and ii) a relationships-based orientation of customer/provider interaction.*

#### *3.3.2.2 The effect of Customer Value Proposition on Infrastructure and Network*

Compared to the business logic adopted by traditional good manufacturers, when products and services are combined, the complexity of internal and external configuration increases (Gao et al., 2009; Johnson and Mena, 2008). In particular, new resources, capabilities and skills which may be new to the company could be required (Baines et al., 2010; Brady et al., 2005; Davies et. al, 2006; Cook et al., 2006; Brax and Jonsson, 2009; Davies et al., 2006; Storbacka, 2011; Vandermerwe, 1990; Martinez et al., 2010; Cohen et al., 2006), and new departments could be created to facilitate the development of customer-centred services (Tuli et al., 2007; Miller et.al, 2002; Sawhney et al., 2004), with an impact on relationships between the business functions within the company and, in general, on the organisational architecture of a firm (Cook et al., 2006; Oliva and Kallenberg, 2003; Johnstone et al., 2008; Windahl and Lakemond, 2007; Mont, 2002).

Moreover, a collaboration with other partners and suppliers could be needed (Evans et al., 2007; Pawar et al., 2009; Matthyssens and Vandenbempt, 2008). This shift from a supply-chain concept to a value-creation network logic (Lusch and Vargo, 2006) is characterised by various intensities and realities along with a "collaborative continuum"

(Mathieu, 2001b). Concerning core competencies and skills, research studies reveal that services require a different mind-set, characterised by a higher information (Li, 2011; Mont, 2002) and knowledge intensity (Vargo and Lusch, 2004). This implies the necessity of T-shaped managers, who are problem solvers with expert thinking skills in their home discipline, but have also communication competencies to interact with specialists from different disciplines and functional areas (Storbacka, 2011; Vandermerwe, 1990).

| **Reference** | **Quote(s)** |
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| Baines et al., 2010 | "Finding 14. Many manufacturers have developed additional competences to provide services, particularly technical, communication, and management skills." |
| Brady et al., 2005 | "Our research has shown that both service and product firms develop new capabilities as they shift to becoming Integrated Solution providers". |
| Brax and Jonsson, 2009 | "Several organizational competences have been associated with the solutions business in earlier literature, suggesting that integrated solutions cannot be treated as just bundles added to the firms‟ total offerings; instead they require development of new organizational capabilities." |
| Cohen et al., 2006 | "To manage the after-sales services business effectively, most companies require skills and knowledge they don't yet possess." |
| Cook et al., 2006 | "The requisite capabilities to enable service delivery included those required for in use maintenance and repair as well as the additional back office financial competencies needed for the collection of revenue based transactions. These skills were additional and quite different to those required to support their manufacturing activities."<br>"Firms that had developed these capabilities had very different organisational characteristics and dynamics to those pursuing the traditional manufacturing model of business. New human resource requirements and new departments had been created to facilitate the development of a customer responsive service, and this required significant investment in both management time and financial resources. |
| Davies et al., 2006 | "Companies that plan to move into integrated solutions must have a clear understanding of what they do well and what new capabilities they need to develop. They must decide which capabilities can be provided in-house, which are no longer required and when partners are needed to fill capability gaps." |
| Evans et al., 2007 | "This research suggests that partnering with organizations |

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| | that have some influence over those later stages of the product-service life may be effective.” |
| Gao et al., 2009 | “Product service systems become powerful and have complex structures. As a result, the management complexity of firms increases.” |
| Johnson and Mena, 2008 | “A servitisation strategy requires the coordination of complex networks of product and service providers.” |
| Johnstone et al., 2008 | “The complex nature of large global organisations was also a recurring challenge. The old ‘product’ business model was characterised by dividing the business into specialist component parts, but P-S means that product, sales and service organisations are now required to work together much more. The new business model therefore requires greater cooperation and co-ordination within complex, divisionalised, global organisational structures to deliver an integrated solution [Miller et.al, 2002; Windahl and Lakemond, 2007].” |
| Li, 2011 | “Specifically, a competence in cross-functional information dissemination can efficiently share information about markets and competitors, and such a capability can hence enable the firm to provide a complete range of solutions for its customers. According to Penttinen and Palmer (2007), innovative information technology such as the internet, web cameras, process control systems, etc. can facilitate cross-functional coordination and hence can serve as enabler of transition from provision of product- to service-based value-added solutions.” |
| Lusch and Vargo, 2006 | “It embraces the idea that value creation is a process of integrating and transforming resources (FP9), which requires interaction and implies networks.” |
| Martinez et al., 2010 | “The adoption of product-service strategy requires, among others, acquisition of new capabilities that enable the organisation to compete in new service spaces.”<br>“When a company is transforming to become a provider of an integrated offering, a different degree of insight into the problems and applications of customers is necessary, which calls for a greater degree of cooperation between a provider and its supporting network.” |
| Mathieu, 2001b | Because of the level and specificity of the costs attached to the implementation of a service strategy, a manufacturing company should consider the collaborative option, meaning the implementation of partnerships with potential competitors.”<br>“The collaborative continuum refers to the existence of various intensities and diverse realities in the potential continuum.” |
| Matthyssens and | “We argue that the more advanced the value creation |

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| Vandenbempt, 2008 | strategy of a supplier becomes, the closer the mesh between the different levels of the value chain must be. Our research emphasizes that this process implies the breaking of existing industry recipes. De-commoditization and the transition from basic product to solution are complex phenomena that remain difficult to accomplish by a single company in a value chain." |
| Miller et al., 2002 | "Good solutions frequently call for a whole team or unit of dedicated people, often from multiple geographies, functions, and product lines, to serve, give voice to, and organize around the customer." |
| Mont, 2002 | "Information management will play an increasing role in improving organisational efficiency and customer communication."<br>"Companies that are pursuing the concept of PSSs will need to change traditional structures." |
| Oliva and Kallenberg, 2003 | "We found that a critical success factor for this transition is the creation of a separate organization to handle the service offering." |
| Pawar et al., 2009 | "This paper proposes that value can be most effectively delivered by networks of collaborating firms, integrating the products and services they offer to create the value which customers seek." |
| Sawhney et al., 2004 | "A separate organization dedicated to selling services is therefore useful." |
| Storbacka, 2011 | "The framework emphasizes that firms need to focus not only on the marketing-sales interface, but also more generally on the multi-faceted interfaces between the commercialization process and the industrialization process. Solution business is cross-functional in nature, and firms entering solutions business may, hence, need to define totally new boundary spanning roles, spanning intra-firm and inter-firm functions." |
| Tuli et al., 2007 | "[…] delineating the four relational processes that constitute a solution brings into sharp focus organizational issues involved in developing and delivering solutions and highlights the importance of developing mechanisms for coordinating the different functions and units that perform the four relational processes. For example, the sales or business development functions typically perform requirements definition, whereas the customer support function performs postdeployment support. As we discussed previously, it is important for these functions to be "on the same page" for each of the four processes if the supplier is to deliver an effective solution. Similarly, it is important for a supplier to coordinate its various business units engaged in the four relational processes. Suppliers may want to consider initiatives discussed in this research, |

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| | such as documentation emphasis, incentive externality, and process articulation, to enhance functional and unit coordination." |
| Vandermerwe, 1990 | "Solution systems invariably require new skills which the company may or may not have."<br>"From sales to project/interdisciplinary team management." |
| Windahl and Lakemond, 2007 | "A strong focus on the creation of a separate organizational unit for integrated solutions may have several advantages and creates a necessary focus on this activity within this specific unit. However, besides the necessity to create internal focus in order to develop integrated solutions, there is also a need to create mechanisms for interaction and integration with other organizational parts of the company in order to sustain the integrated solution and make it part of the company's business (cf. Davies, et al., 2007; Lakemond & Berggren, 2006). It is therefore important to create a structure for integrated solutions that can co-exist with established organizational structures." |
| Vargo and Lusch, 2004 | "The focus is shifting away from tangibles and toward intangibles, such as skills, information, and knowledge, and toward interactivity and connectivity and ongoing relationships."<br>"A more appropriate unit of exchange is perhaps the application of competences, or specialized human knowledge and skills, for and to the benefit of the receiver. These operant resources are intangible, continuous, and dynamic." |

**Table 61: The effect of Customer Value Proposition on Infrastructure and Network – quotes from literature**

***R2**: The servitisation level of the Customer Value Proposition is related to: i) the internal integration among functions, ii) the external integration with partners, iii) the relevance of human resources, and iv) the knowledge-based competences.*

#### *3.3.2.3 The effect of Customer Value Proposition on Economic, Environmental and Social Value Proposition*

Companies offering more servitised solution could tailor their provision to the specific needs of individual customers with "all inclusive", output-, customer value- and

knowledge-based pricing policies (Oliva and Kallenberg, 2003; Vandermerwe, 1990; Richter et al., 2010; Bonnemeier et al., 2010; Sharma and Iyer, 2011).

Moreover, as pointed out by different authors (Vandermerwe and Rada, 1988; Mont, 2002; Mathieu, 2001b; Rothenberg, 2007), understanding PSSs provides the opportunity to see strategic new market opportunities and trends, creating a lock-in effect with customers and a lock-out effect with competitors.

In parallel to the economic discussions, the environmental literature has alighted on PSS as a mean to increase environmental performance (Mont, 2002; Halme et al., 2004; Gottberg et al., 2010; Heiskanen and Jalas, 2003; Hirschl et al., 2003; Rothenberg, 2007). In particular, Tukker (2004) argues that the most promising PSS in environmental terms is the function-oriented PSS, defined as a PS mix with a high level of service content. On the contrary, social considerations are often forgotten or by-passed in literature. Only few authors, (Mont, 2002; Devisscher and Mont, 2008) highlight the positive impact of the servitisation level on the employment and societal dimensions.

| **Reference** | **Quote(s)** |
|---|---|
| Bonnemeier et al., 2010 | "Concerning traditional revenue models, the value proposition of the offering is based on the conventional product or service supplied by the provider. In contrast, innovative approaches focus on the actual input or output of the customer according to the service-dominant logic of marketing (Vargo and Lusch, 2004). This causes a change of the measureable performance parameters and switches the allocation base for price setting from the supplier's costs to the value actually realized for the client (for example, cost savings, increased revenue, and so on)." |
| Devisscher and Mont, 2008 | "It has been demonstrated in this article that this type of system may also provide ways of enhancing the sustainability of society in an integral way." |
| Gottberg et al., 2010 | "The waste prevention assessment showed that the four selected PSS concepts have potential to achieve household waste prevention on new housing developments, even when under certain conditions PSS are consumed as complements to traditional consumption." |
| Halme et al., 2004 | "Why would the services outlined above contribute to eco-efficiency, i.e., to a reduction in materials and energy consumption? There are a number of reasons why efficiency benefits may accrue. Firstly, if the ownership of the product remains with the manufacturer, there is an |

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| | incentive to produce more durable goods. […] Secondly, a lower stock of products is needed if consumers use the same product in sequence. The lower the stock of products, the less material is needed to produce them. […] Thirdly, in result-based services where the operator takes responsibility for product use, the service may facilitate more professional product use. To mention one more instance of the potential of services, the service model may contribute to the choice of a product more relevant to the task." |
| Heiskanen and Jalas, 2003 | "Product-based services and result-oriented services combine a functional orientation with an economic logic in which revenues are decoupled from material throughput." |
| Hirschl et al., 2003 | "Innovative use patterns should be further encouraged, since they can together with eco-efficiency approaches (such as Design for Environment) substantially contribute to an increase of resource productivity of prevailing production and consumption patterns. |
| Mathieu, 2001b | "We propose that the more specific and intense the service maneuver, the higher the strategic benefits." |
| Matthyssens and Vandenbempt, 2010 | "The long-term nature of relational processes for services implies that companies must develop new revenue models based on performance-based pricing and lifelong customer relations." |
| Mont, 2002 | "Understanding PSSs provides the opportunity to see strategic new market opportunities, market trends and developments and potentially to stay competitive"<br>"For consumers, PSSs mean a shift from buying products to buying services and system solutions that have a potential to minimise the environmental impacts of consumer needs and wants."<br>"Understanding PSSs can therefore, help to formulate policies that promote sustainable patterns of consumption and sustainable lifestyles. PSSs have the potential to offer a new way of understanding and influencing stakeholder relationships and viewing product networks, which may facilitate development of more efficient policies. At the same time, it is expected that the promotion of added services or substitutes of products and alternative schemes of product–service use can assist in the creation of new jobs." |
| Oliva and Kallenberg, 2003 | "[…]changes the way the service is priced: from a markup for labor and parts every time a service is provided, to a fixed price covering all services over an agreed period." |
| Richter et al., 2010 | "This [*the expansion of the spectrum of business models from the cost-plus to the use-oriented business model*] directly affects the flows of accumulated costs (LCCi), |

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| | revenues (LCRi) and profits (Pi)." |
| Rothenberg, 2007 | "This article outlined the experiences of three suppliers operating under a business model that allows economic growth to occur while also helping society to step away from the spiral of increasing consumption. In the servicizing approach, material goods are not seen as ends in themselves; instead, companies make money by helping customers achieve their goals while using less product." |
| Sharma and Iyer, 2011 | "Customer-driven pricing strategies may be more effective in solution selling." |
| Vandermerwe, 1990 | "From product to knowhow-based pricing." |
| Vandermerwe and Rada, 1988 | "The overriding motive driving "servitization" is to gain a competitive edge."<br>"Setting Up Barriers To Competitors"<br>"Setting Up Barriers To Third-Parties"<br>"Setting Up Barriers To Customers"<br>"Creating Dependency"<br>"Differentiating The Market Offering" |

**Table 62: The effect of Customer Value Proposition on Economic, Environmental and Social Value Proposition – quotes from literature**

***R3**: The servitisation level of the Value proposition is related to the creation of: i) economic, ii) environmental, and iii) social value.*

### 1.1.1. The conceptual model

The constructs and the variables constituting a Sustainable PSS Business Model are summarised in Table 63.

| **Construct** | **Variables** |
|---|---|
| Customer Value proposition | Product Ownership<br>Product Use<br>Decision Making Power<br>PS Offering Focus |
| Infrastructure and Network | Assets and Resources<br>Competences<br>Value Network Configuration |
| Relationship capital | Market Segment<br>Channel Strategy<br>Relationship Dynamics<br>Customer Integration |

| | |
|---|---|
| Economic Value Proposition | Revenue Structure<br>Cost Structure<br>Market Presence<br>Competitive Advantage |
| Environmental Value Proposition | Material Use<br>Energy Consumption<br>Water Consumption<br>Waste Generation<br>Emissions of Pollutants to Air, Soil and Water |
| Social Value Proposition | Employee Equity<br>Employee Satisfaction<br>Human Rights<br>Health, Safety and Security |

**Table 63: The Sustainable PSS Business Model: its constructs and variables**

Its graphical representation is then proposed in Figure 33.

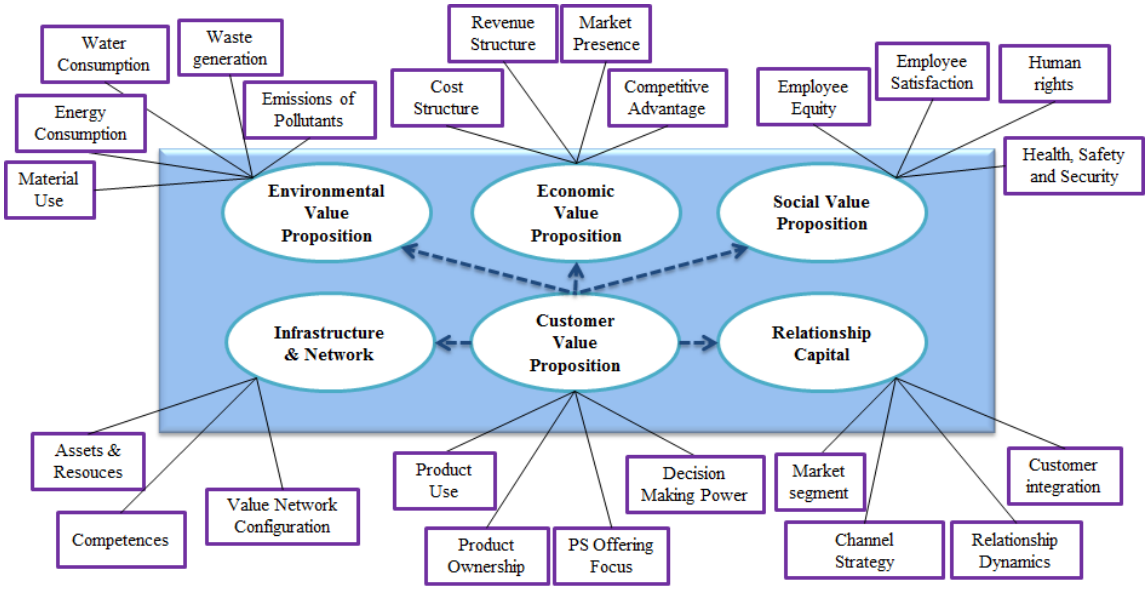


**Figure 33: The Sustainable PSS Business Model: conceptual model**

## 3.4 The research questions

The next step in designing the research is the definition of the research question behind the study (Voss et al, 2002).

Despite the need of guidelines on how to overcome the challenges related to the management and the provision of PSSs (Vandermerwe and Rada, 1988; Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Brax, 2005; Martinez et al. 2010; Baines et al., 2009), there is still little empirical research conducted to understand how

the introduction of integrated PS offerings impacts on a company, as also demonstrated by the systematic literature review reported in Chapter 1. Moreover, *servitization* is considered by the majority of scholars as a binomial variable (*servitized* / not *servitized*) and the PS offering is treated as a homogenous entity, bypassing the evidence that *servitization* happens along the PS continuum presented in the paragraph 3.3.2, and that different levels of *servitization* of the offering may have different impacts on the other dimensions of the underlying business model. It means that the management of a product-oriented PSS requires different skills, capabilities, partners, organisational architecture and relations with the customers compared to a result-oriented PSS.

In addition, literature neglects to analyse if (and how) different aspects characterising a PS offering affect different aspects of the other dimensions of a PSS business model, or influence the same aspect but with a diverse effects. In case these impacts exist, the proposed conceptual model would comprise relations between variables. Since only high-order constructs can be linked through propositions (Byrne, 1984), the model should be consequently modified: variables should be then considered as constructs and the constructs as boundaries.

Aim of the research is the investigation of these different aspects related to the *servitization* phenomenon. In particular, the attention is focused on a specific section on the conceptual model. In fact, even if the importance of understanding the customer's role for the success of *servitization* is recognised, only the Customer Value Proposition and the Infrastructure and Network constructs and the relationship between them will be empirically investigated.

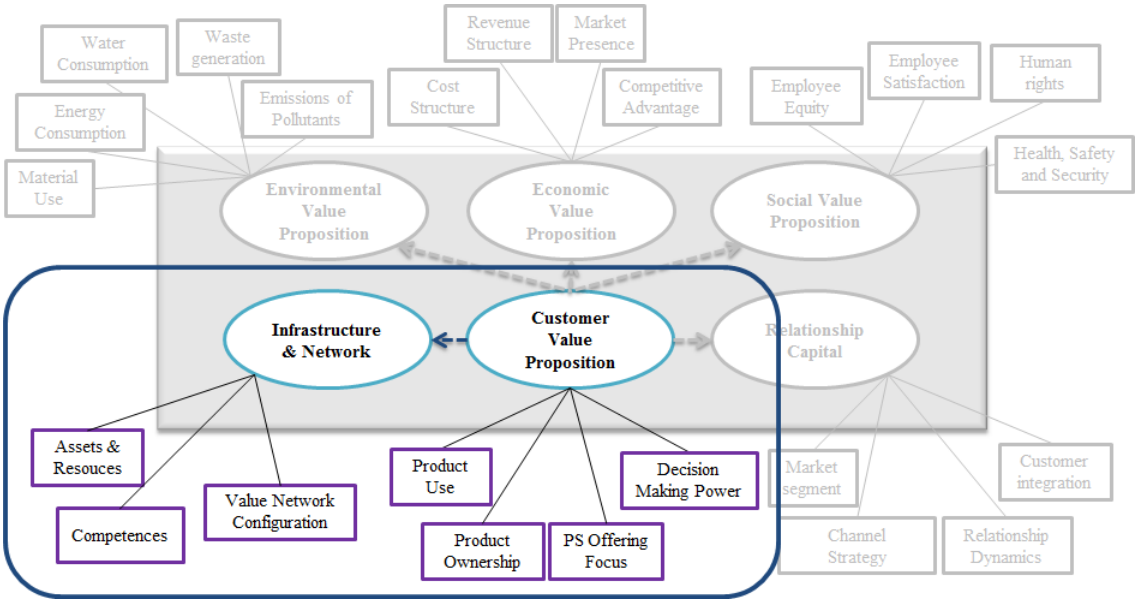


**Figure 34: The Sustainable PSS Business Model - section under investigation**

There are two main reasons for such a choice:

1. the investigation of the impacts of the Customer Value Proposition on Infrastructure and Network and on Relationship Capital requires a different level of analysis compared to the assessment of the effect of the Customer Value Proposition on the Economic, Social and Environmental Value Proposition. In other words, since different types of PS offering can be offered by the same company, it is fundamental to analyse the business model behind each one, leading the investigation to the level of individual PS offering. On the contrary, the economic, environmental and social benefits of PS offerings should be assessed considering the whole PS portfolio offered by a company. This consideration emerged from several interviews conducted to explore the field and to design the research. For example, in the automotive sector, repair and maintenance contracts are a way to protect the spare parts business, important source of profit for companies that sell durable equipment (Cohen et al., 2006; Gallagher et al., 2005):

> *"[…] you protect your business by saying the warranty is extended, and therefore if you want the truck to be repaired on warranty, bring it back into their main dealer because that's the best place to actually do it. And the same with the repair and maintenance contract, you bring it back in and therefore, you bring it into our dealership, and our dealership buys the parts off us. So it's the only way that we can actually ring fence our After Sales business, in terms of the dealer network" (After Sales Director)*

Similarly, long term renting contract ensure high value used vehicles, another source of profit for automotive companies (Wise and Baumgartner, 1999):

> *"[…] On the contrary, with a long term renting contract, the residual value of the vehicle at the end of the term increases, since the car is repaired and maintained only by authorised workshops, using original spare parts. The consequence is that we can sell used car at a higher price" (Leaser Key Account Manager)*

2. the Relationship Capital construct refers to customer relationship management features and is predominantly investigated by the Marketing discipline, while this doctoral thesis is mainly grounded on the Operations and Supply Chain Management domain.

Thus, the purpose of this research is to investigate how manufacturers evolve when aiming at increasing customer value through service addition and to shedding light on the main question and its sub-questions:

*RQ: How does the servitization level of a PS offering impact on a PS provider?*

- *RQ1: How does the servitization level of a PS offering impact on the organisational configuration of a PS provider*?
- *RQ2: How does the servitization level of a PS offering impact on the resources and competences required in its management and provision?*
- *RQ3: How does the servitization level of a PS offering impact on the value network of a PS provider?*

The last aspect to consider is related to the Value Configuration Network variable. Since service elements are the innovative elements introduced in a product portfolio to offer PS solutions to the customers, considerations related to the product network are out of the scope of this doctoral work.

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# 4 The research process design

The theoretical maturity of *servitization*, can be considered as nascent. Nascent theories, according to Edmondson and McManus (2007), are those that "received little research of formal theorizing to date that represent new phenomena in the world". In order to achieve a methodological fit between the state of previous work, research method, analysis and expected contribution, we adopted a theory building approach: "Nothing is so practical as a good theory" (Van De Ven, 1989).

## 4.1 What is a theory?

"A theory is an attempt to explain how a system or phenomenon works by identifying the constituent elements of the system and how they interact and relate to each other" (Croom, 2009), used as "principles of explanation and understanding" (Meredith, 1993). As outlined by Wacker (1998), a theory is made up of four components,

- a definitions of terms or variables;
- a domain where the theory applies, defined as the exact setting or circumstances where the theory can be applied;
- a set of relationships of variables; and
- specific predictions.

As represented in Figure 35, the normal cycle of research is composed by three stages (Meredith et al., 1989): i) description, ii) explanation, and iii) testing. The theory-building process iterates through these phases again and again (Wacker, 1998), where descriptive models are expanded into explanatory frameworks, which are tested against reality until they are eventually developed into theories (Meredith, 1993).

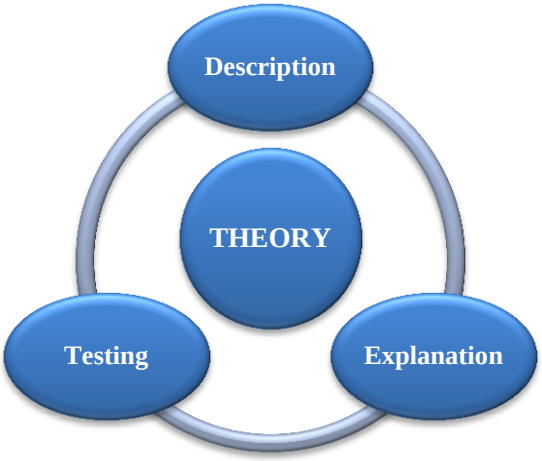



**Figure 35: The normal research cycle**

Doing research involves a process or a series of linked activities (Burgess, 1993; Flynn et al., 1990), whose aim is to answer questions and relate theory and data (Bouma, 1993). Figure 36 provides an overview of the research process. In the first stage, the theoretical foundation for the research is established and the following phases are designed in accordance with both the problem under investigation and the theoretical foundation. It includes selecting an appropriate sample and designing and administering data collection instruments and methods. Then data are gathered and analysed. The final step is preparing the research report for publication.

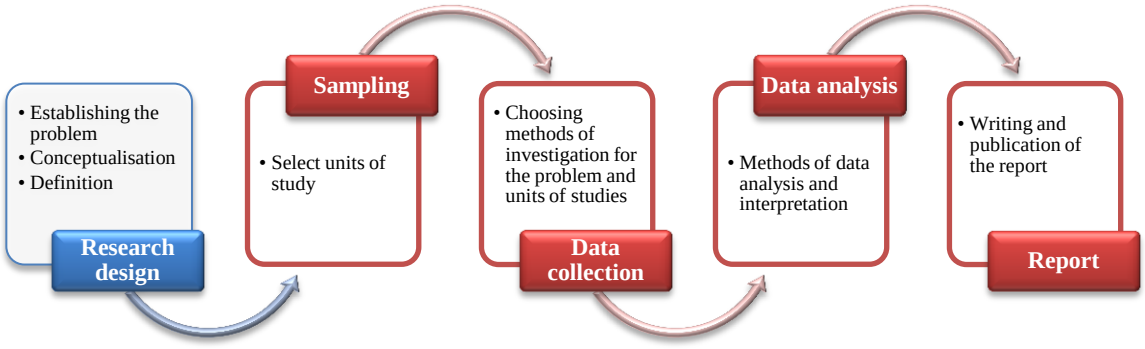



**Figure 36: Representation of the research process (Burgess, 1993)**

## 4.2 The research design process

The design of research process is related to the definition of the chosen topic and of the methods to be employed to investigate the topic (Croom, 2009). In particular, it "guides the investigator in the process of collecting, analysing, and interpreting observations. It

is a logical model of proof that allows the researcher to draw inferences concerning causal relations among the variables under investigation" (Nachmias and Nachmias, 1992).

It is composed by four basic elements (Crotty, 1998):

- Method – technique or procedure used to gather and analyse data related to some research question or hypothesis;
- Methodology – strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desire outcomes;
- Theoretical perspective – philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria;
- Epistemology – theory of knowledge embedded in the theoretical perspective and thereby in the methodology.

In the next paragraphs each element will be discussed within the context of this doctoral research and the choices will be argued.

## 4.3 Methodology: the case study research

Since this study focuses on a "how" and "why" question about a contemporary set of events and, as noted in the previous chapters, addressed a phenomenon not yet thoroughly researched, a case-based approach seems to be the most appropriate methodology to answer to the research questions (Yin, 1994).

A case study research methodology is defined as a "scholarly inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 1994). It is particularly suitable when research question centres on "how" and "why" observed phenomena occur, when there is no control over behavioural events, and when the focus is on contemporary events (Yin, 1994). Moreover, ad argued by Eisenhardt (1989), "this type of work is highly complementary to incremental theory building from normal science research. The former is useful in early stages of research on a topic or when a fresh perspective is needed, whilst the latter is useful in later stages of knowledge".

### 4.3.1 The unit of analysis

The selection of the appropriate unit of analysis is a fundamental step of a case-based research design. The definition of "what a case is" is related to how the research questions have been defined (Yin, 1994). For this research, the case is a company, while the unit of analysis is a single PS offering. Indeed, as already argued in Chapter 3, within the same firm usually exist different forms of PS offerings, that are associated to different organisational requirements, thus leading the investigation to the level of individual PS offering.

### 4.3.2 Single vs. Multiple

Since the research aims at investigating the impact of different PS offerings, characterised by different level of *servitization*, on the Infrastructure and Network variables, a multiple-case study approach was chosen.

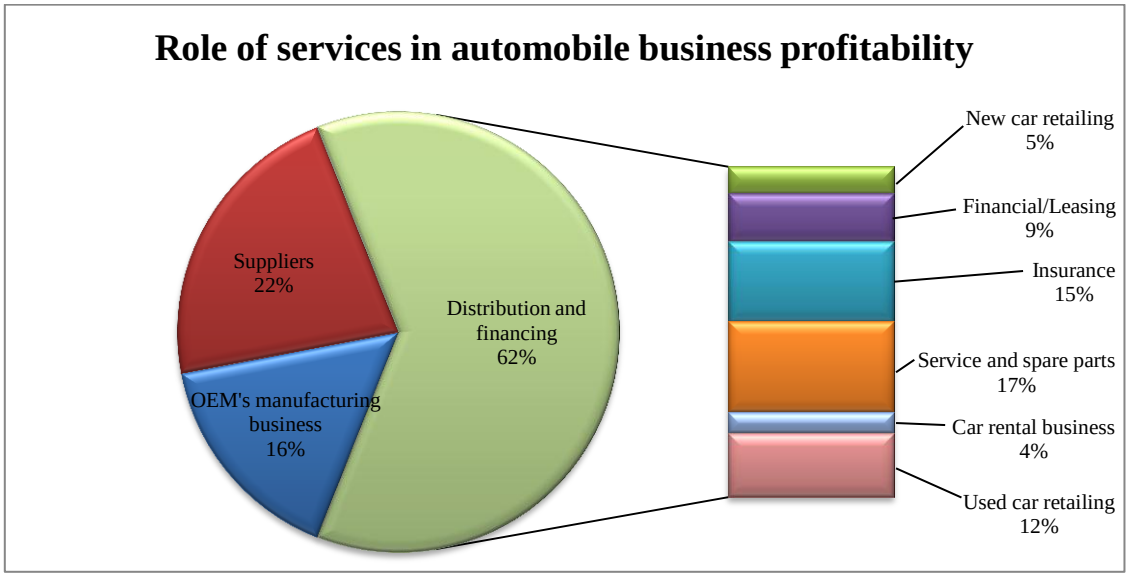
Moreover, an embedded-unit case study design was considered to be appropriate for an in-depth understanding of the characteristics and of the potential differences in various business models that a firm adopts in delivering its several PS offerings. Methodologically, it means that the same case study may involve more than one unit of analysis (Yin, 1994).

### 4.3.3 The selection of the cases

As *servitization* is a phenomenon characterising manufacturing firms, the case companies were selected from the manufacturing industry "for illuminating and extending relationships and logic among constructs", in line with a theoretical sampling approach (Eisenhardt, 1989).

Specifically, in order to partially isolate the effects of strategic context from other potentially confounding factors, the case studies were selected from a single macro-sector: the automotive. As described by several authors (Williams, 2007; Godlevskaja et al., 2011; Lofberg et al., 2010), there are a number of current and historical examples of PSSs and transport solutions in this sector, making such sector an appropriate and interesting empirical field to investigate. Furthermore, services may constitute an answer to the complex forces that are shaping and the industry's future (Kalmbach et al., 2011): "Everyone in the automobile industry knows the business has evolved into much more than "making and selling cars.. […] Now carmakers recognize they must

sell mobility, which is a very different proposition" (Nassif and Valsan, 2011). Several reports confirm this tendency (i.e. IXIS CIB, 2006; McAlinden and Andrea, 2002), showing that in the automobile business value chain more than 60% of the automobile business profits are generated in the distribution and financing stages, as illustrated in Graph 17.




**Graph 17: The automobile business profitability (IXIS CIB, 2006)**

The second control variable is related to the position of a firm within the supply chain: only Original Equipment Manufacturers (OEMs) were chosen. Since OEMs are closer to the end customers, they are able to consider the total life cycle of a product from the customer's perspective, and are in a better position than suppliers to develop services (Lofberg et al., 2010).

The sample of companies involved in the research is non-randomly selected. In fact, according to Eisenhardt (1989), theoretical sampling can be more effective to contribute to theory building. The companies were selected in order to cover different *servitization* levels. In particular, four cases were choosen in accordance with the PSS categorisation proposed by Tukker (2004): i) product-oriented, ii) use-oriented, and iii) result-oriented. Specifically, one case refer only to the product-oriented area (with six embedded units), one case refer both to the product- and the use-oriented group (respectively three and one units), two cases are related only to the use-oriented class (one unit the first one, two the second).

Even if result-oriented solutions exist in the automotive sector, they are not provided by manufacturing companies and, consequently, are not included in the research design.

## 4.4 Methods of data collection

A major strength of case study research is the ability to use several methods of data collection, deriving from multiple sources of evidence. It can include data from direct observation and systematic interviewing as well as from public and private archives (Leonard-Barton, 1990). Yin (1994) identified six sources of evidence: i) documentation, ii) archival records, iii) interviews, iv) direct observations, v) participant observation, and vi) physical artefacts.

The methods, instruments, procedures and general rules to be followed in carrying out the data collection are included in the case study protocol. The protocol used for this study (reported in Appendix 1) was obtained by synthesising the conceptual model[20] used a lens of investigation, into semi-structured interviews. The protocol was then refined through a first pilot case study conducted in a company operating in Italy as a national branch of an international group competing in the truck industry.

For the external network of partner section, the characteristics reported in the rows of the matrix derive from Cannon and Perrault (1999) and Croom et al. (2000). The first one develops a quite comprehensive framework containing the dimensions and variables that can be used to characterise a buyer–supplier relationship. The second one is a literature review on supply chain management, analysed on the base of content- and a methodology-oriented criteria. Regarding the PS provider organisational features, Galbraith (2002) and Antioco et al. (2008) were used as reference papers since they are focused on exploring the organisational features that a solution provider must align with its PS orientation.

For each case, all the conducted interviews were taped and transcribed. Information from the transcripts were categorised and grouped into similar themes, according to the variables and sub-variables objects of the research, and then compared across interviews. Supplementary methods of data gathering were used to triangulate the data obtained from the interviews, including a review of company documentation, publicly

[20] The Sustainable PSS Business Model presented in Chapter 3.

available information and web site. Finally, workshops and project meetings were organised to present empirical data collected, introduce preliminary results, discuss the findings, receive feedback, and review draft reports.

In general, information gathering stopped when theoretical saturation was reached (Strauss, 1987), that is when additional data were considered to result in minimal incremental understanding (Eisenhardt, 1989). However, in some cases, problems in gaining access to key respondents were experienced.

The case studies allowed the identification, evaluation, and matching of patterns as they emerged from within-case analysis in accordance of Eisenhardt's (1989) and Yin's (1994) approach, that prescribes firstly to become familiar with each case as a separate entity in order to identify case specific patterns, and then to make cross-comparison to identify common patterns.

## 4.5 The research quality

The study must be well designed to ensure construct validity, internal validity, external validity, and reliability (Yin, 1994). In particular:

- *Construct validity* is the extent to which correct operational measures have been established for the concepts being studied. Firstly, it has been ensured through the use of multiple source of evidence. Then, based on the transcripts of the interviews, a first draft of the report has been written for each case, inserting follow-up questions to clarify and extend the content. Then, the document has been sent to the companies and reviewed by the case participants. Key findings have been finally validated by the interviewed managers through follow-up meetings and workshops.
- *Internal validity* of the proposed relationships describes whether the right cause-and-effect relationships have been established. The approach followed to validating conclusions was based on pattern matching through the development, for each case, of a thematic conceptual matrix and a causal network[21] (Miles and

[21] A thematic conceptual matrix is a conceptually ordered matrix ("has its rows and columns arranged to bring together items that belong together"), ordered by themes (Miles and Huberman, 1994).
"A causal network is a display of the most important independent and dependent variables in a field study and of the relationships amongst them" (Miles and Huberman, 1994).

Huberman, 1994), compared case by case, and against theory: within- and cross-case analysis (Eisenhardt, 1989).

- *External validity* deals with the generalization of the findings beyond the study. Multiple cases augment external validity and help guard against observer biases. This kind of validity is increased by the use of multiple cases, that should be selected based on both theoretical and literal replication logic. In fact, as underlined by Yin (1994), "each case must be carefully selected so that either it either (a) predicts similar results (a literal replication), or (b) produces contrary results but for predictable reasons (a theoretical replication). For this study literal replication has been ensured selecting more than one case for each PS category, while theoretical replication is based on the presence of at least one case in the different PS categories (except for the result-oriented group).
- *Reliability* demonstrates that the operations of a study can be repeated, with the same results. The case protocol, discussed in the previous paragraph, is a mean to accomplish reliability.

## 4.6 Epistemology and theoretical perspective

The research process followed in this study derives largely from the approach suggested by Yin (1994), Eisenhardt (1989) and Voss et al. (2002). In particular, according to these authors, case studies can be viewed as "quasi-experimental", i.e. situations in which the experimenter cannot manipulate behaviour but in which the logic of experimental design may still be applied. As argued by Yin, "The result is not claimed to be science but the emulation of the scientific method". In other words, the adopted case study methodology is based on positivist ideas (Dubé and Paré, 2003), as also confirmed by the criteria that are applied to evaluate case study research (construct validity, internal validity, external validity, and reliability), commonly used in the positivist and post-positivist paradigms in order to find "objective" conclusions.

Furthermore, the study is based on an inductive approach, characterised by an empirical observation as a starting point, and then its use to try conclusions and find the rule (Karlsson, 2009). However, no matter how inductive the approach, a priori specification of constructs can help to shape the initial design Eisenhardt (1989). Although early identification of possible constructs can be helpful, it is equally important to recognize

that it is tentative in theory building case research. Voss et al. (2002) stress the importance of research framework and questions as starting point for case research, and the development of a conceptual model (Miles and Huberman, 1994) that includes not only the key factors, constructs and/or variables, but also the presumed relationships amongst them. The empirical investigation reported in this doctoral dissertation is based on the conceptual model developed in Chapter 3, and used as lens of investigation.

All the characteristics of the research process underlying this study are summarised in Table 64.

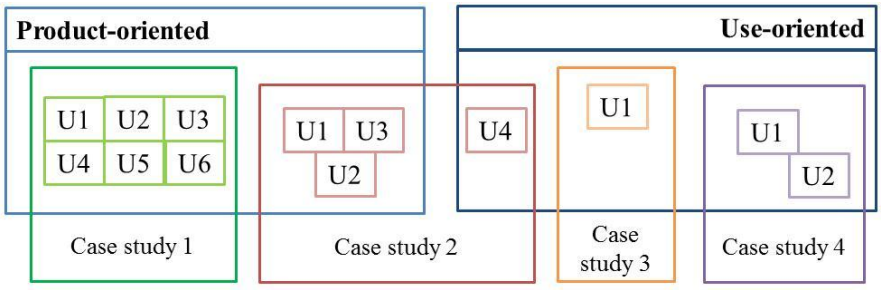
| | |
|---|---|
| Type of research question | How? |
| Conceptual model | Sustainable PSS Business Model (Value Proposition and Infrastructure and Network construct) |
| Methodology | Case study |
| Case | Company |
| Unit of analysis | PS offering |
| Type of case | Embedded multiple-cases |
| Number of cases | Four case studies with 13 units of analysis |
| Selection of cases | Automotive sector   |
| Method(s) | Semi-structured interviews, questionnaire, company documentation, web site |
| Epistemology and theoretical perspective | Positivist<br>Inductive |

**Table 64: The research process characteristics**

## 4.7 The use of the conceptual model

It is important to remark the role of the conceptual model developed in the previous chapter. The model, composed by general constructs and variables, as well as tentative propositions (logical statement and not epistemological relationships), was used as a supporting guideline of the empirical inquiry, characterised by theory building rather than theory testing purposes. As a consequence, the empirical investigation, that basically aims at building the structural model, can at the same time cause modifications to the measurement part (constructs and variables). For example, the case analysis could reveal the presence of causal relationships between variables. In this case, given that only high-order constructs can be linked through propositions (Byrne, 1984), the proposed structural model should be modified: variables should be considered as constructs and the constructs as boundaries.

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# 5 The empirical case studies

## 5.1 Case Study 1: Truco

### 5.1.1 The Truck Industry

The truck industry is characterised by sales drops, a rampant price competition and a low product differentiation caused by regulated standards (Porter, 2008). Moreover, traditional sources of profit, namely vehicle sales, are in decline and customer expectations are in a state of transformation: clients want transportation solutions, not simply a vehicle. As a consequence, vehicle manufacturers around the world are trying to expand their operations into the service business and to establish the provision of value around customer solutions, moving from transactional to relational models, and addressing the customer's use of the vehicle as opposed to supporting the product (Rishi et al., 2009).

This new perspective involves a significant re-thinking of product-led companies and it manifests itself in a variety of potential changes, which include, among others, consulting in the areas of driver education, emergency support services, off-site inspection and repair, extended warranties, fleet management and telematics services, customer friendly opening hours and customer-tailored service packages (Brooks and Reast, 1999). There are several reasons for this transformation: servicing the customer throughout the vehicle's lifecycle, obtaining a steady cash flow from services, increasing sales and an increased demand from customers for services, to give some examples. Financial services, such as lease and rent contracts, provide successful examples of how vehicle manufacturers have extended their business to include services usually offered by financial institutions. However, the ambition is to extend the service portfolio to cover even larger parts of the vehicle's lifecycle. Hence, the traditional business model of selling vehicles and spare parts is changing.

### 5.1.2 The Company

One of the major players in the global transport world, the company investigated (hereafter referred to as Truco) is an international leader in the development, manufacture, marketing and servicing of a vast range of light, medium, heavy and

special vehicles. The product offering is complemented by a range of financial and after-sales services, as well as activities for used vehicles. Service business accounts the 25% of the whole turnover of the company.

The analysis has been carried out directly at the headquarters of the company and not in a national subsidiary. This perspective gives useful information on how PSSs are developed and managed, especially for more *servitized* solutions, often centrally delivered and controlled.

Through company visits and telephonic contacts, seven top managers from Sales and Marketing, Customer Service and Customer Centre business units were interviewed. Moreover, direct observations and the analysis of secondary sources were used for triangulation.

### 5.1.3 The Value Proposition

The services proposed by Truco to its customers, reported in Table 65, were firstly identified through an analysis of the company's web site and a questionnaire sent to the contact persons involved in the Customer Service business unit.

| | **Service** | **Service Description** |
|---|---|---|
| 1 | Repair and maintenance services | Repair services after a failure and maintenance activities (not covered by a contract) |
| 2 | Repair activities during the warranty period | Repair activities delivered during the two years general warranty. |
| 3 | Spare parts | Sale of spare parts |
| 4 | Remanufactured parts | Sale of remanufactured parts |
| 5 | Assembly & Spare parts promotion | Fixed price assemblage of spare parts |
| 6 | Extended warranty | Extended warranties are extensions to the company warranty, and can include cover for material defects, driveline contractual related components and other key components. |
| 7 | Maintenance contracts | Planned maintenance contracts proposed in 4 versions |
| 8 | Full maintenance contracts | Maintenance contracts based on continuous remote controls and prognostic technologies |

| | | |
|---|---|---|
| 9 | Training | Training services to the drivers to get better performances, assure safety and improve product efficiency in product use |
| 10 | Marketing support | Call centre dedicated to contact new customers and to follow the current customers |
| 11 | Urgent Delivery | Urgent spare parts delivery 24h/24h |
| 12 | Road assistance | Emergency service to support customers in the unexpected event of a vehicle breakdown on road |
| 13 | Assistance Non Stop Web Tracking | Customer Centre dedicated to check on progress, to keep the customer informed and to guarantee about the repair and service of the vehicles |
| 14 | Teleservices | Vehicle diagnosis through telematics |
| 15 | Leasing | Leasing services |
| 16 | Fleet management | Telematics solution to control the trucks of a fleet through real-time data about truck use. |
| 17 | Financial Solution | Tailor-made financial services |
| 18 | Spare part catalogue | Spare part catalogue available also online |
| 19 | Accessory catalogue | Accessory catalogue available also online |
| 20 | Quick Repair | Fast-fit repair services |
| 21 | Environmental and end of life vehicle recovery | Disposal of own end-of-life vehicles at no additional cost for the customer |

**Table 65: Total Truco's PS offering**

Among the 20 services identified, six product-based offerings, corresponding to six embedded units of analysis, have been selected and then analysed:

I. Repair Services - Repair service after a failure;
II. Teleservices - Remote diagnosis and programming through a diagnostic remote platform;
III. R&M contracts - Repair and maintenance contracts, including extended warranties;
IV. Road Assistance - 24 hour, 7 days a week roadside assistance in the unexpected event of a vehicle breakdown;

V. Training - Training services to get better performances, assure safety and improve product efficiency in product use;

VI. Fleet management - Telematics solution to control the trucks of a vehicle through real-time data about fuel consumption, kilometres travelled, speed and driver identity, as well as insights into key performance indicators.

The selection, made by the contact persons involved in the Customer Service business unit, was basically based on the importance that the services have on company's revenue and margin (not necessarily in terms of direct impact).

Even if all the selected PS offerings refer to the product-based category, they represent different *servitization* stages in terms of PS Offering Focus, moving from ensuring the functionality and the availability of the vehicle, to supporting the customer's processes and activities (Table 66).

| **Product Ownership** | **Product User** | **Product Decision Maker** | **PS Offering Focus** |
|---|---|---|---|
| Customer | Customer | Customer | From product to process |

**Table 66: Characteristics of Truco's offering**

Since the PS Offering Focus variable is not binomial, but represents a continuum, a Likert scale (Likert, 1932) from 1 to 5 is used to assign it a value, where 1 represents a total product focus and 5 denotes a total customer's process focus. The value were given by the researchers with the support of the involved managers (Table 67).

| | **Embedded unit** | **Offering Focus** |
|---|---|---|
| 1 | Repair Services | 1 |
| 2 | Telematics service | 1 |
| 3 | R&M contracts | 1 |
| 4 | Road Assistance | 2 |
| 5 | Training | 3 |
| 6 | Fleet management | 4 |

**Table 67: The selected embedded units and evaluation of the PS Offering Focus variable**

For each PS offering (representing a single embedded unit), a descriptive analysis of the Infrastructure and Network variables is provided in the following paragraph.

### 5.1.4 The embedded units

#### *5.1.4.1 Embedded unit 1: Repair and Maintenance Services*

Repair and maintenance services are provided by the company through a technical assistance network of authorised dealers and workshops, considered as fundamental partners and an interface between the corporate and the customers. In each country, the network is organised in two levels. The first tier includes mono-brand dealers, some of them providing also after-sales services, directly managed and controlled by the headquarters. The second tier is composed by workshops, nominated and managed by the first-tier dealers. However, the standards required to a workshop and its geographical position are defined by the headquarters, that has also the authority to validate the contract.

The authorised workshops are classified into three categories along with an increasing "level of excellence", evaluated through 34 KPIs organised in 6 areas (Assistance Non-Stop, Spare Parts, Training, Vehicles Off Road, Tools and Customer Satisfaction), measured once a year. The first level fulfils only the basic standards needed to be nominated, related to various aspects of the Training, Vehicles Off Road and Tools areas. The second level workshops, in addition to the standard requirements, have to satisfy other parameters in the three aforementioned areas and several KPIs also in the Assistance Non-Stop dimension. Finally, the third category is supposed to cover all the 34 KPIs.

The first-tier dealers monthly have to provide to the headquarters reports related to their activities. They are also responsible for collecting similar data from the workshops and for transmitting the information to the headquarters.

Monetary bonuses related to four categories (Vehicle Breakdown Downtime, Parts Available on the Dealer Shelf, Training and Tools) can be provided by the company to first-tier dealers, which in turn share them with the second-tier workshops.

Communication between the company and the assistance network (first and second tiers) happens through ICT (Information and Communications Technology) systems, including a web portal and an intranet server. Moreover, a Dealer Management System

(DMS) integrated with the company ERP, is contractually imposed for the first-tier dealers. On the contrary, interactions between the company and the second-tier workshops happen in two ways: indirectly through the first-level network, and directly through the District Manager, whose responsibilities refer both to spare parts management and to technical coordination.

The company sells to the assistance network spare parts (delivered through a spare part supply chain), supporting and diagnostic tools, and knowledge (through training programs, catalogues and documentation). The dominance of technical courses in the training programs highlights the fundamental role of technical competences for the assistance network. However, several behavioural training programs (including marketing, relational and managerial notions), currently optional, are going to become mandatory for both the dealers and the workshops.

On the other side, information about market trend, spare part stock and selling, as well as customer satisfaction, have to be collected and communicated by the dealers to the company.

Internally, the business unit "Customer Service" is responsible for developing and managing the workshops and after-sales activities. Headed by the Vice President Customer Service, it comprises three sub-units:

- Line activities, including: i) Sales and Marketing, for spare parts and technical coordination of the repair network, ii) Supply chain, for spare part distribution and warehouse management, iii) Service, focused on the provision of training programs for technicians, the design of new diagnostic tools and telediagnosis services, as well as the definition of repair timing;
- Workshop Development, that is involved in workshop and network development, training program monitoring, quality standard definition and service offering evaluation. Moreover, it is in charge to manage information, documentation, time sheets and technical support for workshops. Finally, it defines European standards in line with each national regulation;
- Staff activities, that includes human resources management, finance, accounting of this business unit.

The structure of the Customer Service business unit is depicted in Figure 37.

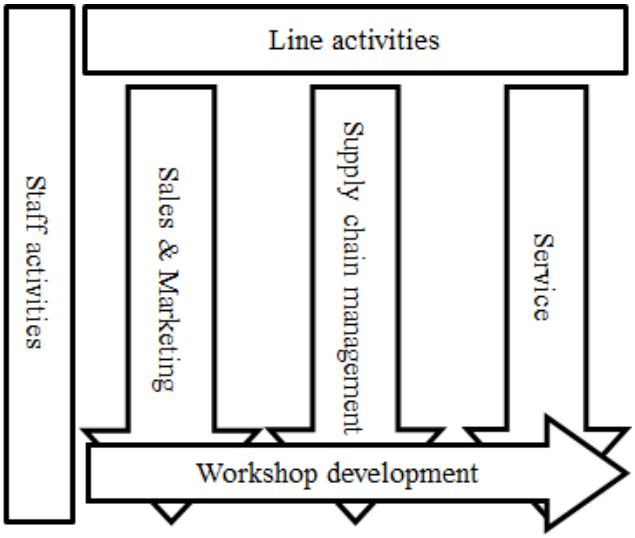


**Figure 37: The Customer Service structure**

During a repair service, in addition to the quality and the availability of the spare parts, granted by the Sales and Marketing and Supply Chain lines, it is of fundamental importance to have well-trained mechanics in the workshop, since they are able to solve problems in a better way and in a shorter time. In this case the Service line needs to grant to mechanics a high quality training. It means that the different lines have to interact to assure a high quality level of the repair service and, consequently, a better results in terms of customer satisfaction and loyalty.

In addition, Workshop Development, transversal with respect to the Line activities, works to find the suitable composition of service network to satisfy customer needs through:

- designing a proper coverage network, equally distributed in the country at an international level;
- monitoring the workshops performances, according to the 34 KPIs previously introduced;
- defining quality standards to ensure the same services in every workshop in the European area;
- thinking different kind of services depending on the type of customers.

Through these activities the Workshop Development aims at assuring a high level of customer assistance and simultaneously monitors the profitability achieved through service delivery both for the corporate and the workshops.

Such a structure, characterising the headquarters, is then replied in the eight national branches that the company has worldwide, excepted for the Supply Chain activities, existing only centrally.

The Customer Service business unit, both at headquarters and national level, is a profit centre, as well as its sub-units. The main strategic objectives pursued are short-term profitability, effectiveness in service delivery and customer satisfaction. As a matter of fact, during the budgeting process, the main objectives assigned to the Customer Service are both financial and non-financial. With regard to financial objectives, the business unit is responsible for profits and losses, segmented in different markets and sub-units. Both spare parts and services net and gross sales and profits are analysed. Other financial objectives regard average spare parts stock, spare parts purchasing price, cost of goods sold, logistics costs, warrantees costs, claims, overheads, etc. With regard to non-financial objectives, recently Truco has launched a service programme for dealers and workshop (both for the first and the second tier) that comprises all objectives concerning service quality, customer satisfaction, technical assistance lead times, refusal, tools, technical competences, medium term investments, etc. Managerial reporting at business unit level is comprised by a weekly report. It focuses on: i) sales of spare parts (mainly related to repair activities), maintenance and repair contracts, and other services; ii) movements from and into stocks; shipments; iii) total number of claims received, etc.

In addition, a monthly report, that presents the financial results of the Customer Service and its sub units, is drawn up. With regard to the overall business unit, profits and losses are reported, highlighting gross sales, net sales, cost of goods sold, and actual gross profit, for both spare parts, repair services and maintenance and repair contracts. Then, overheads and trading profit (EBIT) for the Customer Service are measured. Moreover, profits and losses are segmented into different geographical markets, focusing especially on products and spare parts net sales. Additional balance sheets information such as stock available per month, stock rotation index, slow moving items, receivables, overdue receivables, account payables, investments are measured and monitored. Some non-financial indicators such as productive versus non-productive personnel (administrative and back office one) are also measured,

Figure 38 summarises graphically how repair and maintenance services are delivered to the customers.

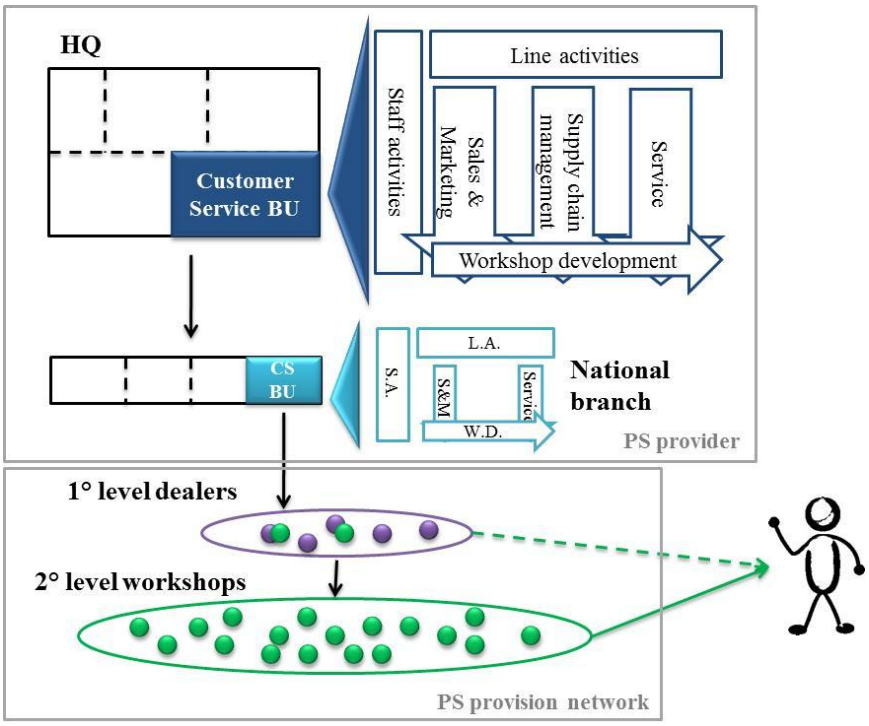


**Figure 38: Repair and maintenance services**

### *5.1.4.2 Embedded unit 2: Telematics services (Teleservices)*

Telematics is becoming an indispensable element of a truck, impacting everything about the vehicle and its usage, and supporting truck companies to build solutions for the customers. These solutions should focus on the areas that most concern customers: service, safety, driver assistance, regulatory compliance and sustainability.

This embedded unit refers to the impact of telematics on repair and maintenance services. The telematics technology is used by Truco to identify any problems quickly and reliably, and to enable the workshop to solve problems efficiently. The company has created a new diagnostic platform that allows simple diagnosis of the various electronic control units on the vehicle, using a communications module (ECI) and a specific Personal Computer (PC). PCs are bought from a company (Teleco), leader in consumer electronics and technology products, while the specific software (core part of a diagnostic platform) has been designed by an external company belonging to the same corporate group as Truco, recently absorbed in the Engineering Department of Truco, highlighting the increasing importance of developing new skills in this area. Diagnostic

telematics services are provided to the customer/user through the whole assistance network, as all the workshops are required to have a diagnostic platform among their tools. Data sourced from telematics services are used to build Early Warning Reports and are directly communicated by the technicians of dealers and workshops to the national subsidiary of pertinence. These information are then sent by the branch to the headquarters. At this level, the Quality, Engineering and Production departments use these information to jointly improve critical product features. The logic of telematic services delivery is reported in Figure 39.

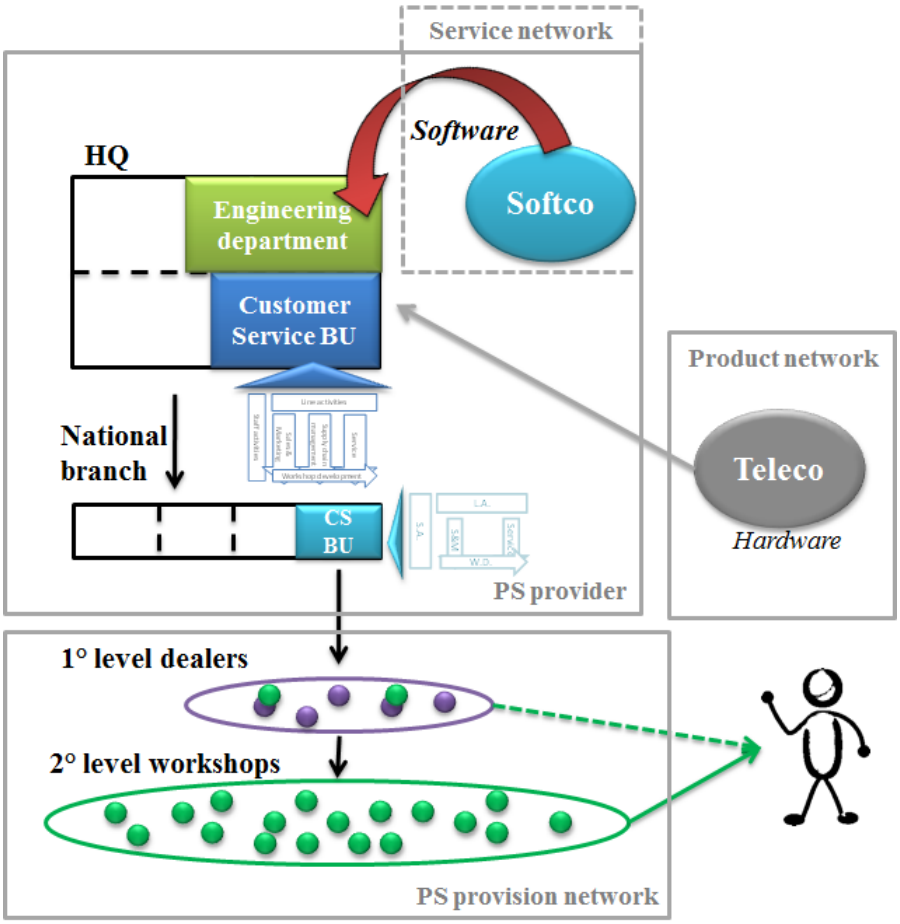


**Figure 39: Telematics services**

### *5.1.4.3 Embedded unit 3: Repair and Maintenance (R&M) contracts*

For R&M contracts, the dealer acts as a negotiator on behalf of the company when a new vehicle is sold. The types of contracts offered to the customers and their price are centrally defined by Truco, while their sale and provision are directly managed by the sale and assistance network.

Internally, the sale network is managed by the Sales&Marketing business unit, with the support of the Customer Service business unit for contract design, bidding, pricing and monitoring. Despite of these close relationships, there is no formal structure for communication between the two business units.

As for Customer Service, Sales&Marketing is a profit centre and is built upon three sub-units:

- Line activities:
  - Sales, for products and services contracts and technical coordination of the dealer network;
  - Marketing, responsible for marketing and pricing policies analysis and proposition, product standard definition, market analysis, benchmarking and market positioning, coordination and implementation of initiatives of communication and advertising;
  - Service, supporting the sales force of dealers with training programs and technical support;
- Network development, responsible for designing the first level network, carrying out customer satisfaction surveys and analyses, defining dealer's qualitative standards, and supporting network plan;
- Staff activities, includes human resources management, finance, accounting of this business unit.

The structure of the Sales&Marketing business unit is depicted in Figure 40.

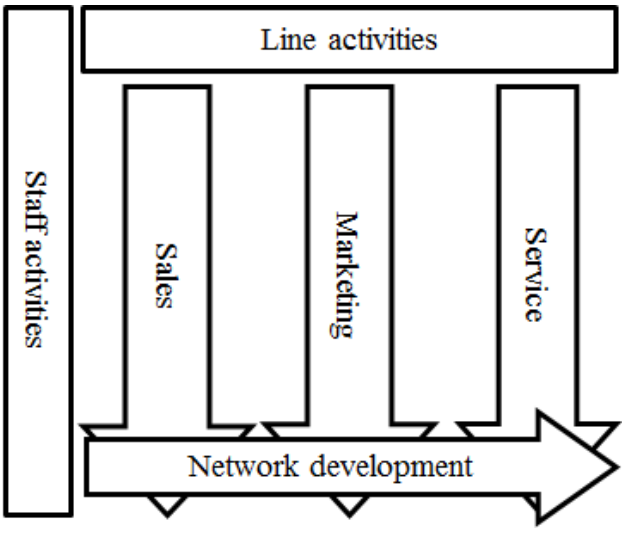


**Figure 40: The Sales&Marketing structure**

The headquarter business unit is then replied in each national subsidiary.

The main strategic objectives pursed are related to the number of products and service contracts sold, as well as to customer satisfaction.

Repair services delivered during a R&M contract (in terms of labour hour sold and parts) are paid by the company to the workshops. Moreover, monetary bonuses, related to the number of contracts sold, are given to sales dealers, and proper training courses are delivered. The competences required to the sales-force are not limited to product features anymore, but embrace also relational skills and the capacity to understand customer's needs. Even if the workshops of the assistance network can sell R&M contracts to the customers (in case the customer buys the contact after the vehicle purchasing), they do not receive any direct incentives. However, the more contract are signed, the more spare parts and labour hours are sold by the assistance network to Truco, basically representing an indirect incentive in promoting and selling R&M contracts.

Even if the sale and provision of R&M contracts involve both Customer Service and Sales&Marketing business units, there are not formal communication activities or shared databases. Only informal relations have been established between people belonging to the two units.

Figure 41 reports how repair and maintenance contracts are managed by Truco.

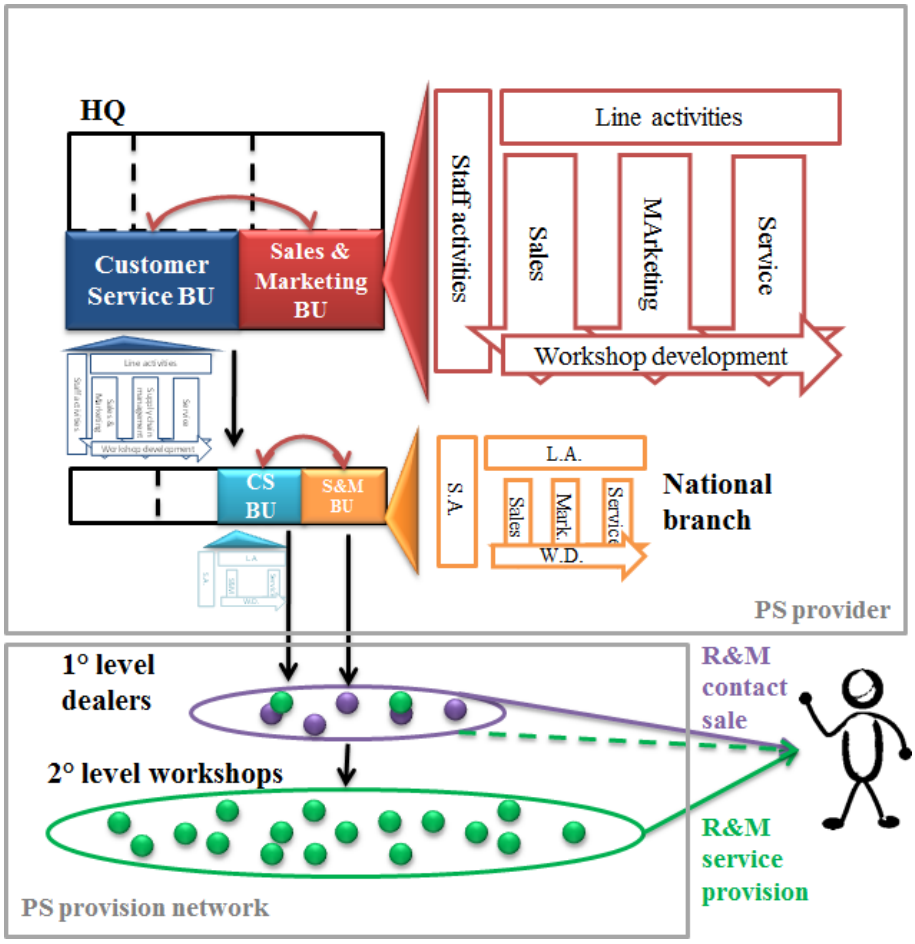


**Figure 41: Repair and maintenance contracts**

### *5.1.4.4 Embedded unit 5: Road assistance*

To support the roadside assistance program, Truco established in 1999 the Customer Centre, that represents a first point of contact for customers in the unexpected event of a vehicle breakdown. The Customer Centre (Figure 42), that ensures ten spoken languages, co-ordinates all roadside assistance activities from first contact to roadside repair (78% of cases), or where necessary, recovery to a franchised workshop. Even if it is a sub-unit of the Customer Service business unit, it is defined as a "company in the company" to highlight its autonomous identity, composed by four sub-units:

- Front line assistance (24h/24), handles callings, activates the workshop closest to the breakdown point, and provides assistance and feed back to customers;
- Back line assistance, monitors the repair activities and is involved in the invoicing and escalation processes;

- Customer Relationship Management (CRM) deals with the "contact us" section of the web site and with lead management activities, while Marketing support, is involved in research and brand promotion activities.
- Supporting activities, such as recruitment, training and staff development, service implementation, business analysis, process development, budgeting and invoicing, etc.

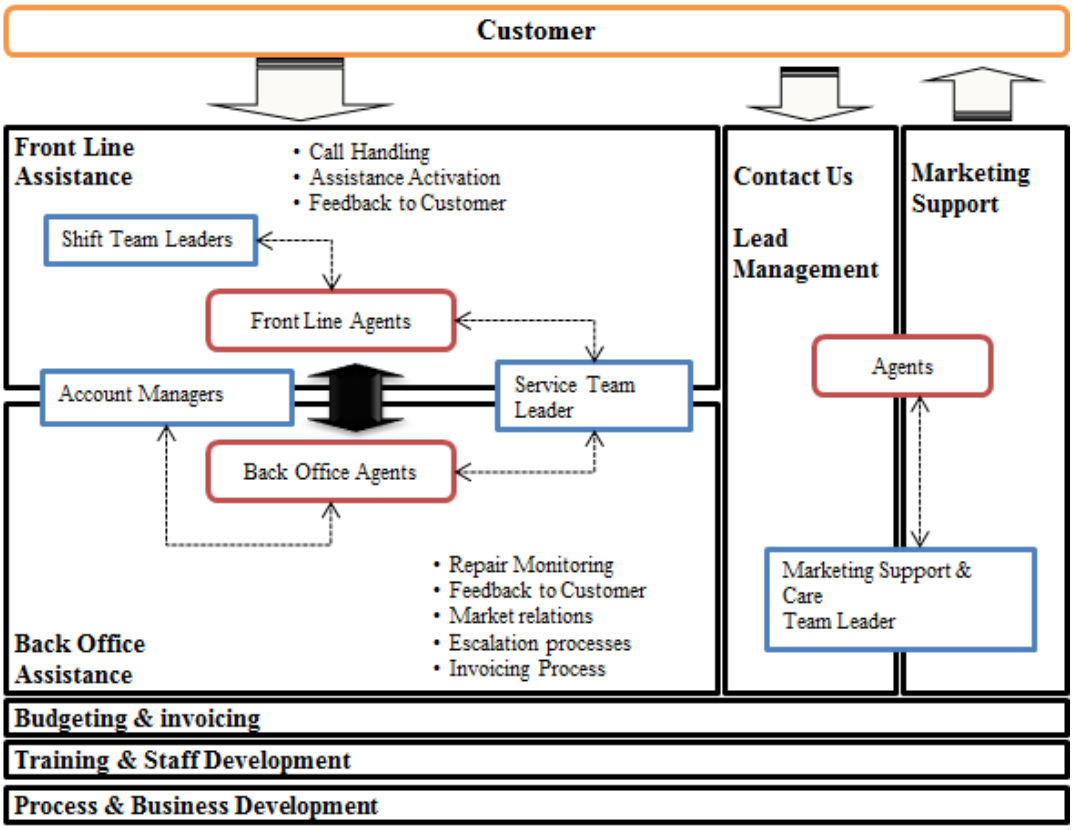


**Figure 42: The Customer Centre structure**

For the provision of the road assistance service, the CRM units (Contact Us, Lead Management, Marketing Support) are not involved.

In order to guarantee a high level service, the recruited people need to have and in-depth market knowledge, strong problem solving skill and attitude, and speak three languages. Every employee gets technical and product training, as well as market procedures and a continuous tutoring.

Automatic identification of the customer and the vehicle, breakdown location and nearest workshop identification and real time feedback to customers are supported by

the use of Information and Communication technologies, as well as customer and vehicle databases.

The information collected by the Customer Centre related to product faults and defects are then sent directly to the Product Quality department. Finally, during the assistance process, the Customer Centre checks on progress, keeps the customers informed and guarantees that the vehicle is back in service as quickly as possible. Moreover, feedback regarding effectiveness, efficiency and timeliness of the provided service are sent to the other sub-units of the Customer Service business unit.

The KPIs used to monitor the activities of the Customer Centre mainly refer to three areas: i) Calls, ii) Staff, and iii) Dossier.

The selected variables regarding Calls are: calls total number, missed calls, waiting time and surrender time. Each variable is segmented according to the following dimensions: data, time, language, and breakdown (workshop) area.

The Staff area is monitored through the number of operators, segmented according to the dimensions of data, time and language.

The selected variables regarding Dossier, segmented according the data dimension, are:

- time to assistance: measured as difference between the arrival time on break-down area and the calling time;
- time to repair: measured as difference between the arrival time in the work-shop and the vehicle delivery time;
- detected rate of repairs: measured as ratio between the reported repairs and the total number of calls to Customer Centre.

Moreover, for the Dossier area, the Number of calls, measured as the calls number needed to solve a dossier, is segmented according to the dimensions of data, inbound calls number, outbound calls number and client code. Finally, the Daily number of opened dossiers is segmented according to the dimensions of data, time, language, breakdown area, breakdown market and truck model.

The visual representation of performance trend is displayed at the entrance of the Customer Centre.

Road assistance delivery is depicted in Figure 43.

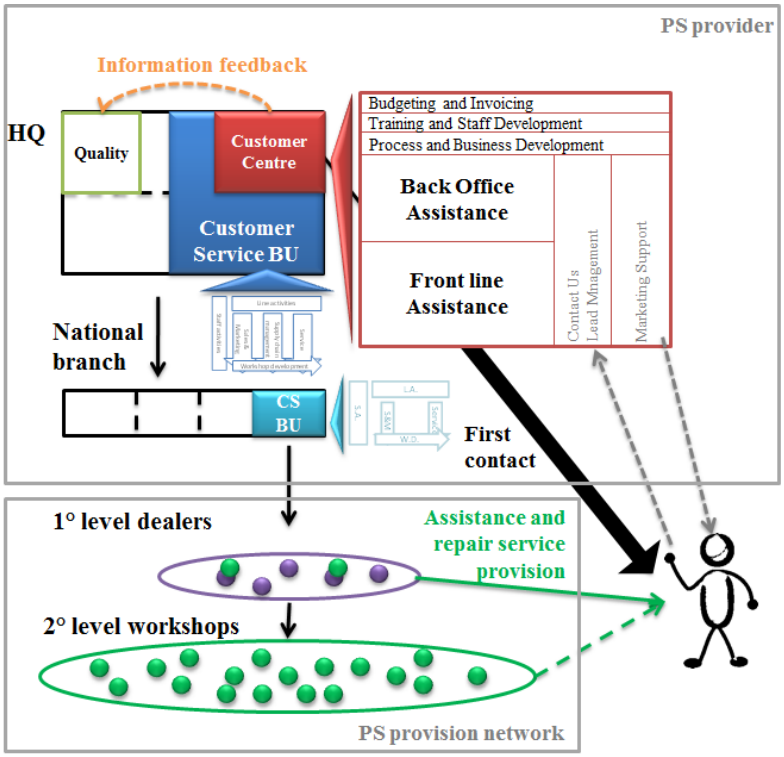


**Figure 43: Road Assistance**

### *5.1.4.5 Embedded unit 4: Training to the driver*

Increasing fuel prices and pressures on drivers have made driver training more important than ever. Therefore Truco promotes several training programs to optimise driver skills, reduce fuel consumption, and increase driving safety. Even if the content and the aims of each training program are set by the company only (through the Service sub-unit of the Customer Service business unit), courses are designed and provided in conjunction with a school belonging to the same Group (Educo). They are sold through the Truco website and delivered either centrally or by national branches of the school. Information about the number of trained drivers and their satisfaction are used to measure and control the service quality. Figure 44 reports the driver training delivery structure.

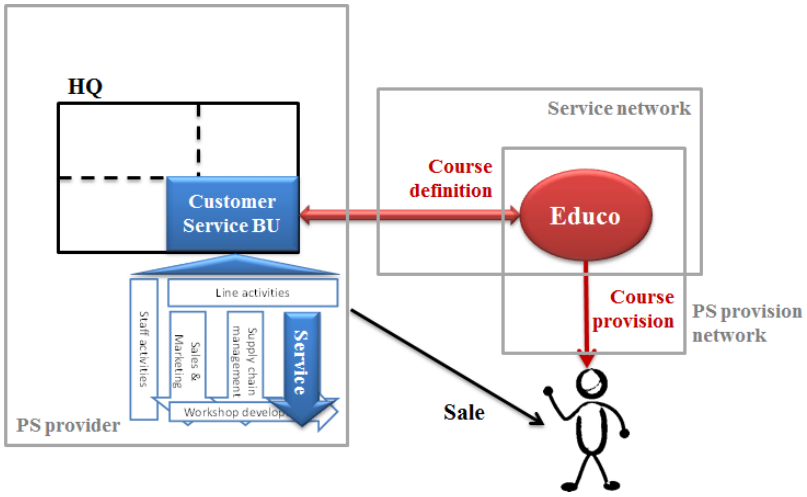


**Figure 44: Training to the driver**

### *5.1.4.6 Embedded unit 6: Fleet management*

Based on the telematics technology, the fleet management platform captures all the main vehicle-related data, including fuel consumption, directly from the engine and chassis system control units. The system also incorporates a GPS receiver, allowing the vehicle location to be tracked at any given moment. All data are transmitted via GPRS and can be accessed using an Internet browser via a dedicated Web portal. This offering is based on telematics and fleet management competences. It is the result of a collaboration of Truco with a company (hereafter referred to as Fleeco) leader in telematics, fleet management and related services. In the delivery phase, Truco installs the hardware on the truck (optional device bough by customers) only, while Fleeco provides the related fleet management services and handles all the customer data through a Web portal, offering to the customer immediate access to information and key performance indicators. On the contrary, Truco does not have any access to these data. However, since customer data are considered highly valuable, the Engineering division of Truco is collaborating with Fleeco to develop an integrated platform able to communicate with the telematics diagnostic tool already installed on the truck. The final aim is to have an integrated solution to provide different services and to have access to vehicle and customer's data. The data on product use gathered by the Customer Service through the fleet management solution can be utilise to design new services (i.e. tailored training programs) and then transmitted to the Customer Relationship Management

(CRM) sub-unit, belonging to Sales&Marketing business unit, that will be involved in the analysis of the information, as shown in Figure 45.

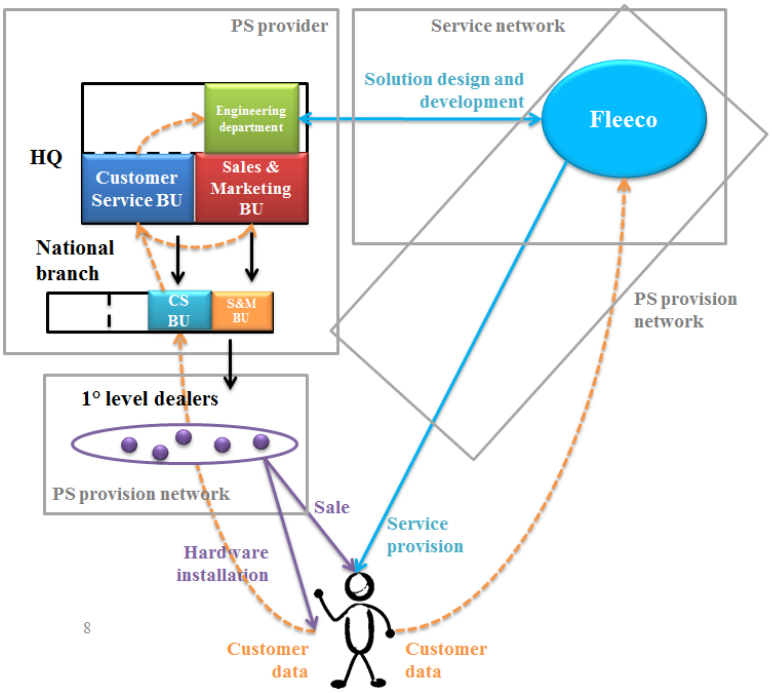


**Figure 45: Fleet management (desired state)**

### 5.1.5 Within-case analysis

In this section, a conceptual matrix (Miles and Huberman, 1994), depicted in Table 68, is developed and populated using evidence from empirical data, and used as basis for the cross-case discussion reported in the next chapter.

The first section of the matrix is devoted to define what are the competences required by each service and how these competences are allocated (internally and/or externally). The second section (Internal involvement, Activities performed internally, Intra-firm relations, Objectives& Responsibilities) describes the organisational features of the PS provider (Truco), while the third part (Partner(s), Type of relationship, Legal ties, Content of exchange, Resource sharing infrastructure, Decision style, Level of control, Risk/Reward sharing and incentives, Geographical presence) refers to the external network of partners. The characteristics reported in the rows of the matrix derive directly from the case study protocol (see paragraph 4.4).

For the embedded units considered in this case, the only variable that changes is the PS Offering Focus.

#### *5.1.5.1 From a focus on the product to a focus on the customer's process*

In case of product-oriented offerings (O.F.=1), it is interesting to notice that the main company partner for the PS provision network is the assistance network. Strong technical competences are required and the content of exchange mainly refers to physical assets, information on product, as well as technical knowledge. Decisions are centralised and there is a high level of control on the network through both structured measurement and reporting systems, and an "excellence program" for workshops. Moreover, since the franchised workshop network is the only partner that actually provides the services, the Customer Service business unit (in charge of developing, managing and supporting the network) has a central role in providing these solutions. The involved resources are a mix of tangible (spare parts and tools) and intangible (human resources and information).

On the contrary, moving towards process-oriented solutions (O.F.=2; O.F.=3; O.F.=4) demands new competences, increasingly related to the activities involved in owing and using the truck. For example, training courses are provided to the user of the vehicle, while the fleet management solution supports vehicle owners in managing their business. Since such competences are not internally and totally available, new actors are required, as service suppliers and as service providers at the same time. Those actors are external partners that bring complementary competences (for example Fleeco for Fleet management services), and that are managed by the After-Sales function that acts as an integrator of capabilities. Moreover, the required resources have an intangible nature and refer to human resources, knowledge, information and software.

#### *5.1.5.2 Introducing a new aspect: the PS Offering Technical Requirement*

Compared to the other offerings, telematics and fleet management services are characterised by the need of a new technology (especially telematics technology) and the redesign or improvement of product technical features. This aspect can be depicted through the use of a new variable, namely *PS Offering Technical Requirement*, that measure whether the introduction of a new service requires specific technical product features to be delivered. As shown by telematics and fleet management services, the need of a technical redesign impacts on product design and entails the involvement of the Engineering department. In particular, for telematics services, the required software was developed by an external company belonging to the same corporate group as Truco,

recently absorbed in the Engineering Department, underling the increasing importance of developing new skills in this technical area. On the contrary, fleet services are completely provided by an external company, leader in this business. However, Truco is recognising the strategic importance of a fleet management offering not only for collecting product data and user's information, but also for building customer loyalty. Then, a platform able to communicate with the existing diagnostic tools for teleservices is currently under development by the Engineering department in partnership with Fleeco, creating a strong co-operation between the two companies.

#### *5.1.5.3 The introduction of new services (Service Expansion)*

The introduction of new PS offerings, no matter their specific characteristics, impacts on the internal organisation of Truco and on the involved functions. This aspect is introduced in the model as *Service Expansion.* Excluding repair and maintenance services and road assistance that are provided "on demand", that is in response to a customer's requirement, when new services are introduced, the Sales&Marketing business unit is involved in the service business. It is in charge to develop and manage the network of sale dealers and to promote the services to the market. The incentives given to dealers are proportioned to the number of service contracts signed with the customers. Training programs are delivered to salesmen to improve their relational skills and their ability to understand customers' needs, not only in terms of product features but also in the area of services supporting the product and its use. Moreover, customers' data collected through different service provision are used to segment the market and tailor the offerings on actual customers' characteristics and requirements.

As already supposed during the development of the conceptual model, the empirical investigation has shown that the variables of the model are interrelated and that different Value Proposition variables impact on different Infrastructure and Network variables or on the same variable, but with different effects. Since only high-order construct can be linked through proposition, the variables of the model are then transformed into constructs and the constructs into boundaries.

Graphically, the impacts of a change of the PS Offering Focus (from product o customer's processes), of the PS Offering Technical Requirement and of the general introduction of new services (Service Expansion) are shown in Figure 46. The

conceptual model developed in Chapter 3 has been used as starting point, and then transformed into a conceptual framework[22] through an empirical inquiry of the case study.

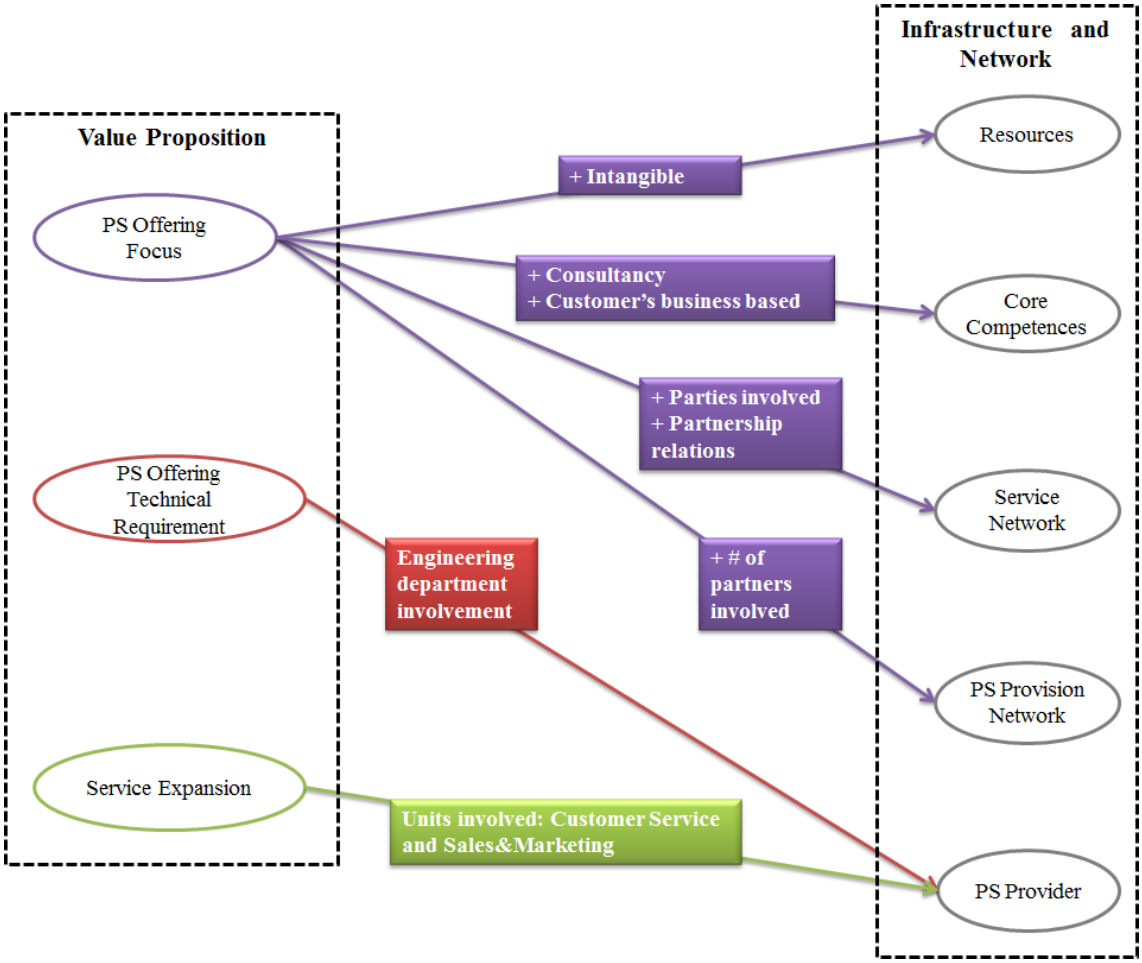


**Figure 46: Truco - The research conceptual framework**

[22] As remarked in Chapter 3, the difference between a model and a framework sits in its explanatory power. While a model is built to represent or describe a particular phenomenon, a framework contains also a collection of propositions which explain the phenomenon (Meredith, 1993).

| | Repair services | R&M contracts | Telematics | Road Assistance | Training | Fleet management |
|---|---|---|---|---|---|---|
| *Competences* | | | | | | |
| Required competences | Technical on vehicles | Technical and commercial | Technical on vehicles<br>. Diagnostic software design and development<br>. Hardware development | Communication<br>. Problem solving<br>i. Technical on vehicles | Educational and technical | Telematics and fleet management |
| Allocation of competences | Technical competences: external partner | Technical and commercial competences: external partner | Technical on vehicle and on computers and communications solutions: External partners<br>. Software design and development: Truco | Communication, problem solving and technical competences: Truco<br>. Technical competences: external partner | . Technical competences: Truco<br>i. Educational competences: external partner | Telematics and fleet management: external partner |
| *Resources* | | | | | | |
| Required resources | Technicians, spare parts, supporting tools, technical information. | Salesmen, technicians, spare parts, supporting tools, technical information. | ICT, technicians, technical tools and information. | ICT, call centre people, technicians, spare parts, supporting tools, technical and customer information. | Trainers, information, knowledge. | ICT, software programs as information collectors and processors. |
| *Value Network Configuration – PS provider* | | | | | | |
| Internal involvement | Customer Service (CS) BU | Customer Service and Sales & Marketing (S&M) BUs | Engineering department and CS BU | Customer Service BU (in particular the Customer Centre (CC) sub-unit) | Service sub-unit of the Customer Service (CS) BU | Customer Service (CS) BU, Sales & Marketing (S&M) BU, Engineering department |
| Activities performed internally | Management of franchised workshops for the actual provision of the | i. CC: contact point with customers for vehicle breakdown. | i. Eng. Dep.: Sofware design and development<br>ii. CS BU: sale of telematics to the | i. CC: contact point with customers for vehicle breakdown.<br>ii. CS: management of workshops for | Definition of training course content | i. Engineering department: hardware and software development |

| | | | | | | |
|---|---|---|---|---|---|---|
| | services | ii. CS: management of workshops for the actual provision of the service | network | the actual provision of the service | | ii. CS: offering development and data collection<br>iii. S&M: management of dealers for selling the solution<br>iv. CRM (S&M sub-unit): customers' data analysis |
| Intra-firm relations | - | Between the two BUs. No formal structure for communication | Between Quality and Engineering departments regarding feedback data from teleservices | Constant information flow between the two BUs. Feedback to the Quality department | Communication with the entire CS BU | Data flow: from the customer to S&M. From S&M to Engineering dep. and to CS BU |
| Objectives& Responsibilities | CS: Profit centre | CS and S&M: Profit centres | - | CC: Cost centre belonging to CS | CS: Profit centre | Under development |
| *Value Network Configuration – Service and PS provision network* | | | | | | |
| Partner(s) | Assistance network | Sales and assistance network | Teleco for hardware.<br>. Assistance network for diagnostic services | Assistance network (all the workshops of the first level and some of the second one) | Training school | Fleeco |
| Type of relationship | 1st level: strategic partner<br>2nd level: operational partner | | i. Teleco: transactional supplier.<br>ii. Assistance network: strategic partner | See Repair services and R&M contracts | Strategic partner | Potential strategic partner |
| Legal ties | 1st level: with the company.<br>2nd level: with the 1st level | | i. Teleco: as for Repair services<br>ii. Company Y: - | See Repair services and R&M contracts | Belongs to the same group | - |
| Content of exchange | Spare parts, supporting tools, information, knowledge | | i. Assistance network: diagnostic platform, information and | Information | Knowledge | Hardware device - potentially information on |

| | | | | | |
|---|---|---|---|---|---|
| | | knowledge<br>ii. Teleco: Hardware devices | | | customers |
| Resource sharing infrastructure | Spare parts supply chain, catalogues, documentation, ICT, training centre. | . Assistance network: ICT<br>. Teleco: - | See Repair services and R&M contracts | School infrastructure | - |
| Decision style | Centralised on the company | Centralised on the company | See Repair services and R&M contracts | Centralised on the company | Decentralised |
| Level of control | High direct control on the 1st level.<br>High indirect control on the 2nd level. | | | See Repair services and R&M contracts | Medium |
| Risk/Reward sharing and incentives | 1st level: monetary bonuses<br>2nd level: "Excellence program" | - | See Repair services and R&M contracts | - | - |
| Geographical presence | Widespread on the territory | . Assistance network: widespread<br>. Teleco: - | See Repair services and R&M contracts | - | - |

**Table 68: The Truco case study - main characteristics**

## 5.2 Case Study 2: Tenco

### 5.2.1 The Company

Tenco HQ is the biggest firm of the Tenco Group, an international supplier of commercial vehicles and transport solutions. For this case, only the English market has been investigated through the case of Tenco, a wholly owned subsidiary of Tenco HQ, operating as a vertically integrated importer for the UK market.

Tenco is focused on the sales of commercial vehicles, buses, coaches and industrial engines to operators and companies in the UK, including special trucks for the Ministry of Defence. Finally, the company is also specialised in other two niches: hazardous goods market, focused on fuel delivery and transport, and tanker and trailer. Such product offering is then complemented by a range of financial and after-sales services, and activities for used vehicles.

In order to sell products and services, as well as to manage the 60,000 vehicle in service, the company employees around 800 people.

Among the turnover realised in 2010, the After Sales business accounted for approximately 25%, of which 50% come from the sale of parts to the network, 25% from the sale of labour hours for the service activities performed at the wholly owned dealers and 25% from the sale of repair and maintenance contracts.

The interviews, semi-structured around the previously explained conceptual model, were conducted through company visits and telephonic contacts. In total 19 managers from Sales and Marketing, After-Sales and Human Resources functions were involved in the case study. Moreover, secondary sources of data were used for triangulation.

### 5.2.2 The Value Proposition

The services proposed by Tenco to its customers, reported in Table 65, were firstly identified through an analysis of the company's web site.

| | **Service** | **Service Description** |
|---|---|---|

| | | |
|---|---|---|
| 1 | Repair and maintenance services | Repair services after a failure and maintenance activities (not covered by a contract) |
| 2 | Repair activities during the warranty period | Repair activities delivered during the two years general warranty. |
| 3 | Spare parts | Sale of spare parts |
| 4 | Extended warranty | Extended warranties are extensions to the company warranty, and can include cover for material defects, driveline contractual related components and other key components. |
| 5 | Maintenance contracts | Planned maintenance contracts proposed in 4 versions |
| 6 | Training | Training services to the drivers to get better performances, assure safety and improve product efficiency in product use |
| 7 | Assistance Non-Stop | Call Centre dedicated to support customers in the unexpected event of a vehicle breakdown on road |
| 8 | Fleet management | Telematics solution to control the trucks of a fleet through real-time data |
| 9 | Leasing | Leasing services |
| 10 | Financial Solution | Tailor-made financial services |
| 11 | Spare part catalogue | Spare part catalogue available also online |
| 12 | Contract Hire | Financial solution coupled with R&M contracts. The ownership of the product remains with the company |
| 13 | Accessory catalogue | Accessory catalogue available also online |

**Table 69: Total Tenco's PS offering**

Among the 13 services identified, four product-based offerings, corresponding to four embedded units of analysis, have been selected and then analysed:

I. Repair Services - Repair service after a failure;
II. Repair and Maintenance (R&M) contracts - Repair and maintenance contracts, including extended warranties;

III. Fleet management - Telematics solution to control the trucks of a fleet through real-time data about fuel consumption, kilometres travelled, speed and driver identity, as well as insights into key performance indicators.

IV. Contract hire - The basic funding packages are bolt to R&M contracts, representing a complete bundle offering, where the ownership of the product remains with the company.

Differently from the previous case, where the embedded unit were selected *a priori*, the PS offerings to be analysed emerged directly from the interviews and from the different description of the total offering and its constituent elements provided by the managers.

Among the four selected services, three out of four PS offerings refer to the product-based category, representing different *servitization* stages in terms of PS Offering Focus, moving from ensuring the functionality and the availability of the vehicle, to supporting the customer's processes and activities. The fourth one belongs to the use-oriented category since the vehicle stays in the ownership of Tenco.

| | **Product Ownership** | **Product User** | **Product Decision Maker** | **PS Offering Focus** |
|---|---|---|---|---|
| 1, 2, 3 | Customer | Customer | Customer | From product to process |
| 4 | Tenco | Customer | Customer | Process |

**Table 70: Characteristics of Tenco's offering**

Since the PS Offering Focus variable represents a continuum in the case of product-based offerings (embedded unit 1, 2, 3), a Likert scale (Likert, 1932) from 1 to 5 is used to assign it a value, where 1 represents a total product focus and 5 denotes a total process focus. The value were given by the researchers with the support of the involved managers.

| | **Embedded unit** | **Offering Focus** |
|---|---|---|
| 1 | Repair and maintenance services | 1 |

| | | |
|---|---|---|
| 2 | R&M contracts | 1 |
| 3 | Fleet management | 4 |

**Table 71: The selected embedded units for product-oriented offerings and evaluation of the PS Offering Focus variable**

On the contrary, since Contract hire (embedded unit 4) is a special type of financial service and, as such, supports the client's process, the value assigned to the variable Offering Focus is equal to 5.

For each PS offering, a descriptive analysis of the Infrastructure and Network variables is provided in the following paragraph.

### 5.2.3 The embedded units

#### *5.2.3.1 Embedded Unit 1: Repair and maintenance services*

The repair and maintenance services are provided by the company through its assistance network, considered, for after-sales services (like repair and maintenance), as a fundamental partner and an interface between the corporate and the customers. It consists of 68 dealerships, where 17 are wholly owned and the others are private capital, with a size ranging from 10 people to 50, and tied to Tenco through a franchisee contract. The relations between Tenco and the dealers is characterised by a high level of control, implemented through a very structured system of performance measurement and control, related to a system of reward. The aim of this bonus programme is to guarantee a high level of service to the customer. In particular, five KPIs (redefined every year on the basis of the strategic priorities) are monitored and linked to a bonus, paid on a quarterly basis. Every dealer achieving a minimum of four KPIs out of five receives, for each achieved KPI, an additional reward for every Warranty and R&M labour hour claimed upon Tenco. For 2011, the KPIs refer to technical aspects of the service, in particular First Time Pass Rate, Roadside assistance and Preventive Maintenance Inspection. In order to qualify for this bonus programme, the dealers must accomplish several conditions, among which a minimum number of training days. Moreover, every year, the UK’s best dealer for quality customer support is awarded with monetary rewards that can be invested in equipment, tools, and facilities. The competition is based on a maximum of 100 points available to every individual

dealership location. The points are divided into four areas: customer satisfaction, operational quality, corporate (in terms of dealership order and cleanliness) and commercial (in terms of parts performance).The dealership with the highest score is the winner.

Tenco's dealerships are purely after-sales services providers and do not have any kind of responsibilities on the truck sales. As a consequence, their business activities and revenues are essentially related to the sales of spare parts and the provision of repair and maintenance services.

Internally, the dealer network is developed and managed by the After-Sales function. It comprises four areas:

- Service, dealing with warranties, maintenance contracts, services, customer complaints, technical support, training, documentation and product monitoring;
- Parts, responsible for the spare parts' business in terms of supply, distribution, availability and pricing;
- Network, interface between Tenco and the network, responsible for dealer development, standards as well as investment/divestment;
- Business Development, responsible for processes and procedures to improve KPIs, and to introduce new initiatives.

Moreover, four Branch directors, one for each operating area (North, Middle, South-East and South West), report directly to the Head of After-Sales and are responsible for managing the wholly owned dealerships.

The Service and Parts managers of a dealers refer to the Service and Parts manager of Tenco, while the dealer principals (or the branch directors in case of wholly owned dealers) refer to the Network managers.

Communications between the network and Tenco happen through ICT tools and a Dealer Management System (DMS).

The company sells to the assistance network spare parts (delivered through a spare part supply chain), supporting and diagnostic tools, and knowledge (through training programs, catalogues and documentation). In particular, several training programs are provided to the dealers, not only to the technicians to ensure high skill levels, but also to parts and service managers. Furthermore, the salary of technical and parts staff is linked

to their training, skills and knowledge (three levels: junior, specialist, premium). Even if at the moment this approach is implemented only for wholly owned dealers, the aim is to roll it out also to the private capitals.

Repair and maintenance service delivery of Tenco is summarized in Figure 47.

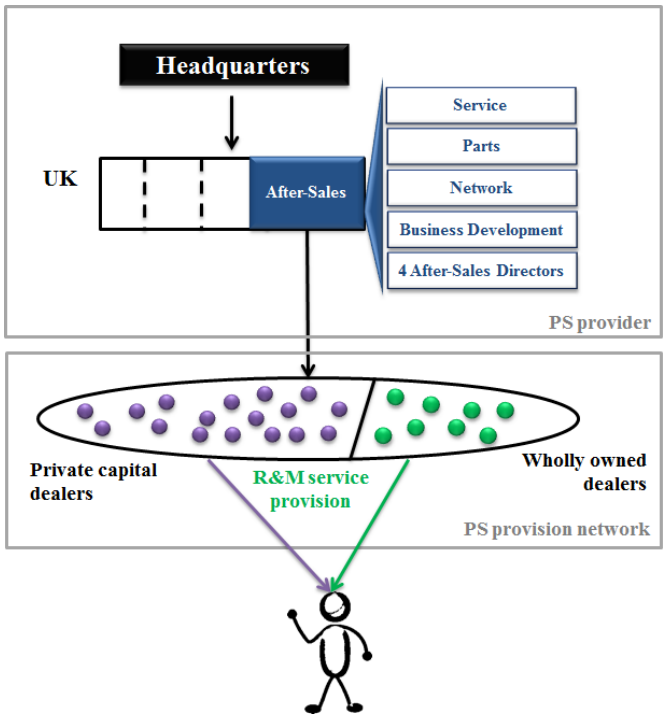


**Figure 47: Repair and maintenance services**

### *5.2.3.2 Embedded Unit 2: Repair and maintenance (R&M) contracts*

Products and services are sold directly to the customer by salesmen employed by the company, with a very structured and consistent approach in the entire UK market. This kind of approach to sales was established in 1999 as an innovative route to market, in response to the Block Exemption Regulation (BER) legislation introduced by the European Commission in 1998. Revising the Dell Direct approach, the company took its salesmen, re-employed them off the dealer network, and made them its employees. As a consequence, the franchise network of dealers became just an after-sales franchise, purely focused on the provision of after-sales services and customer service.

In general, R&M contracts are sold directly to the customer by salesmen on the top of a new truck, picking out from a "kitbag" the basic constituent elements and building up a tailored offering. In particular, according to the size of the customer, the sale of trucks

and services is managed by the Retail Sales function or by the International and National Key Accounts departments.

Sales people are incentivized not only on selling vehicles, but also on selling R&M contracts. Actually, selling services has a higher weight in the global incentive scheme.

In addition, salesmen are trained to become "transport consultants" and to be able to understand the customer's business and operations, in order to sell the best solution for meeting its needs.

There are also situations (a few) in which the service is not jointly sold with a new truck. In this case, the R&M contract is sold directly by the dealer. This happens when the customer decides to buy services after the purchase of the trucks or when R&M contract on new or used trucks expired and the customer wants to renew it. Repair and maintenance services during a R&M contract are provided to the customers through the dealership network. Moreover, these services are paid by the company to the dealers in terms of labour hour sold and parts, and they are able to guarantee about 50% of the business of a dealer. Even if Sales and After-sales functions manage the same customers, there is a loose formal relationship between the two, and no shared database where customers' data can be collected. The only formal contact point between Sales and After-sales is an accounting format that reports monthly sales of trucks and order bank, as well as a handling charge for each transaction, that the assistance network receives from the company. Informally, the fact that salesmen sit in the assistance dealers close to after-sales people, increases coordination and information sharing.

R&M contract delivery is reported in Figure 48.

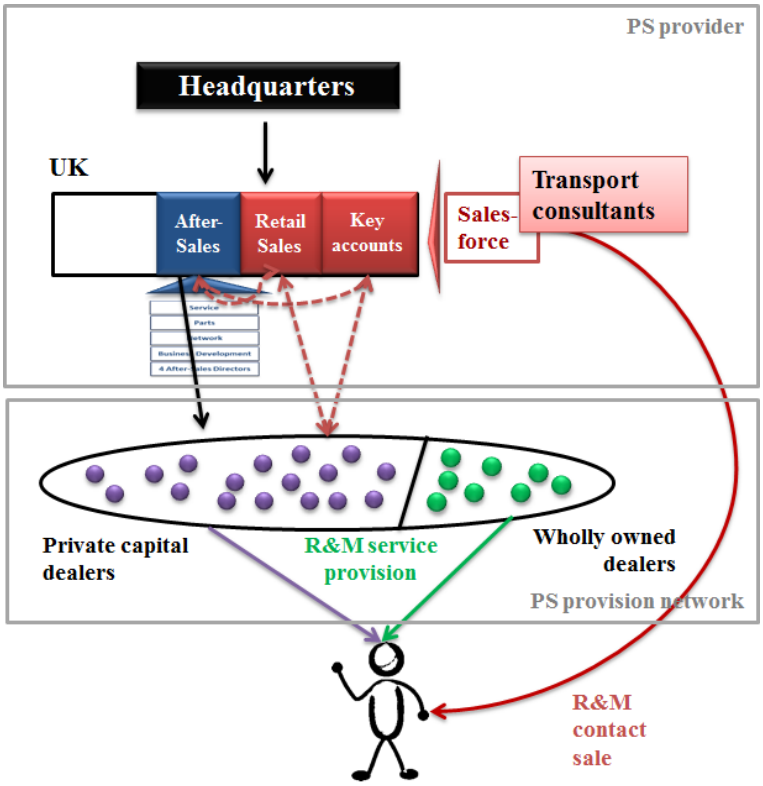


**Figure 48: Repair and maintenance contracts**

### *5.2.3.3 Embedded Unit 3: Fleet management*

Tenco Fleet Management is a combination of software systems that the company provides to help customers manage their fleet more effectively, meeting their legal requirements for documentation, inspection and servicing of their vehicles in line with legal directives.

The fleet management solution, introduced in 2007, was designed and developed for the UK market through a partnership of Tenco with Trateco, a leading transport management solutions provider, with specialised competences in vehicle tracking and telematics, as well as transport management and planning. While the technical features of the fleet management system (hardware) were developed centrally by Tenco HQ and its engineering department, software and communication modules were the objects of the partnership between the two firms.

The management and storage of all required documents and certification (relating to the fleet of vehicles, their usage, maintenance and inspection histories) is carried out through the Document Management Database. The solution is a managed web service hosted by Trateco at their enterprise data centre on dedicated servers. Input of data is a mixture of electronic transfer of data from Tenco and the automated scanning and input

from the dealers, generated through inspection, control, repair and maintenance activities. Customers use a simple web browser, with user name and password, to view the data of their fleet and generate reports. Real-time alerts inform customers of missing or expired documents and any road worthiness issues which need to be addressed.

Moreover, the fleet management system provides visibility of driver and vehicle performance to allow improved driver professionalism, fuel economy and road safety. It is possible through the connection of the Tenco website to the engine management system of the vehicle, allowing a continuous collection of information concerning the operation and performance of the vehicle. These data are transmitted in real-time to the website using GPRS communications and are used to create reports showing how the vehicle is being driven by the driver together with the actual fuel consumption and the level of achieved fuel efficiency.

Internally, data from the fleet management solution are managed by the After-Sales function, both by the Service and the Business Development area. The latter, in particular, used the gathered data to design new services and training programs, tailored on the specific characteristics and needs of the customer.

Finally, the service is usually sold by salesmen with the sale of a new truck, as shown in Figure 49.

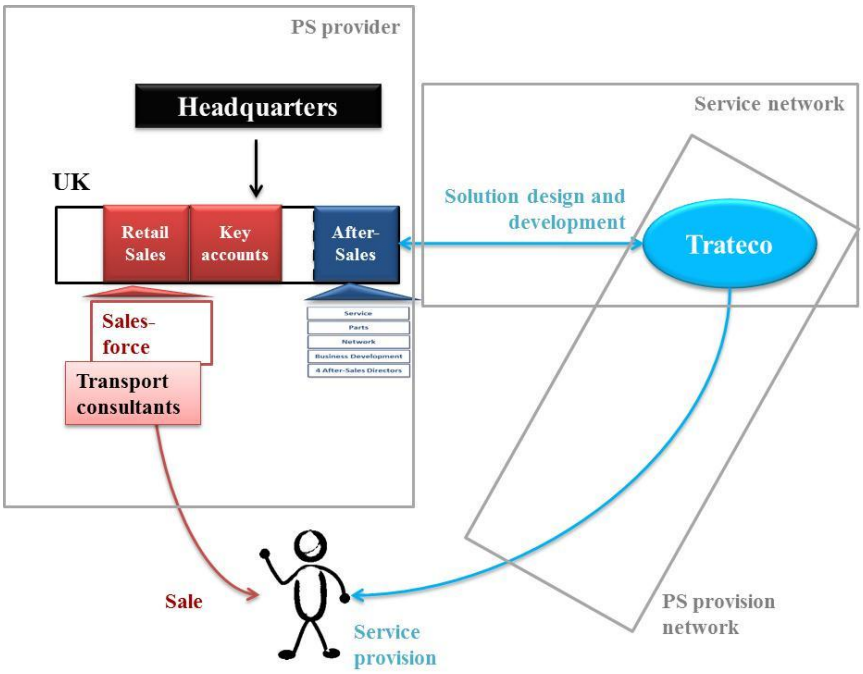


**Figure 49: Fleet management solution**

In addition, the fleet management solution is included as a standard add-on to all product sold with a R&M contract (Figure 50).

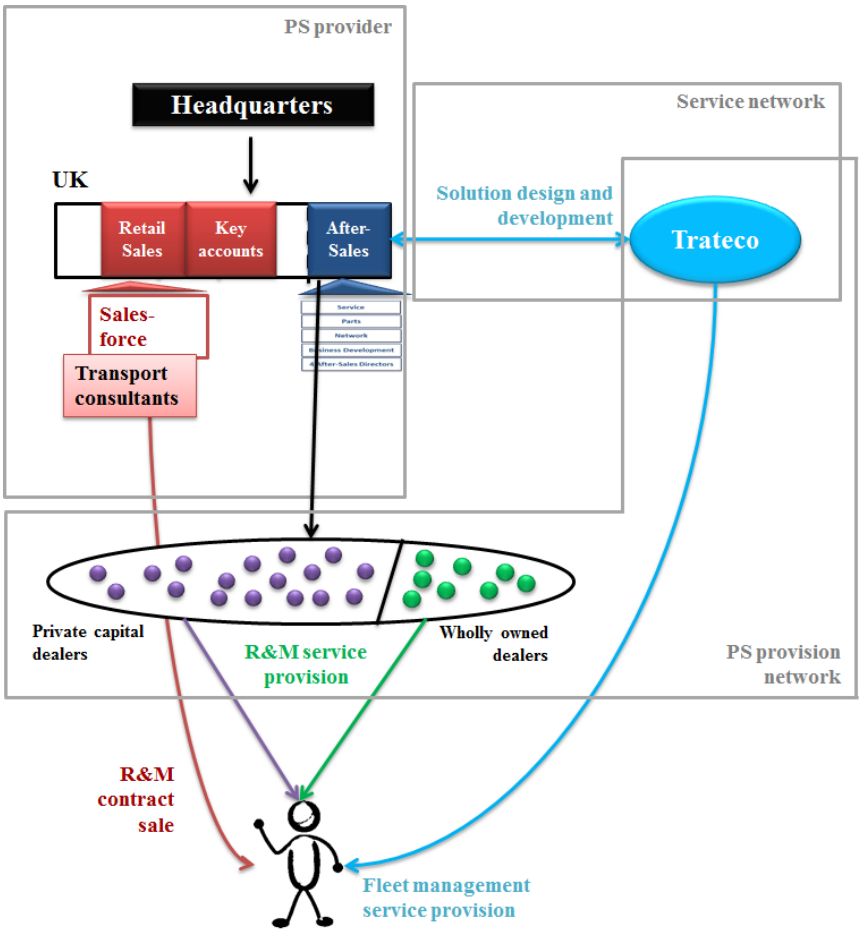


**Figure 50: Repair and maintenance contract including fleet management**

### *5.2.3.4 Embedded Unit 4: Contract hire*

Contract Hire provides vehicle operators with a system where they can simply hire the use of a vehicle for a predetermined period against an agreed monthly charge for its use. It includes the purchase price of the vehicle, a predetermined 'end of contract' residual value, the cost of funding the contract, the cost of the vehicles road fund licence over the contract period, the cost of a R&M contract and the replacement tyres for the vehicle. With the exception of the vehicles insurance and the fuel it uses, there are no further operating costs involved with contract hire.

As for R&M contracts, this solution is sold by salesmen. This aspect not only confirms the need of consultancy competences for the sale executives, but also extend them, since it requires not only a clear knowledge of customer's operational needs, but also the

ability of the sales force to understand the customers' financials and balance sheet in order to identify what solution might meet better its needs. Financial competences have been brought to Tenco by FinTenco UK, the UK subsidiary of FinTenco Group. FinTenco Group, established as the financial service provider of the Tenco Group, with its subsidiaries supports the sales of its sister company in all relevant international markets. As part of the Tenco Group, FinTenco is able to understand the peculiarities of the truck industry and of the commercialised products, as well as the requirements of the customers. FinTenco also performs directly front- and back-office activities to manage customers' needs and requirements during the entire contract. Even if FinTenco is an independent company, from a managerial point of view it is considered a Tenco's internal business unit.

Since hire contract is an integrated package of different services, provided by different actors, a database shared between After-sales, Sales and FinTenco has been developed. Moreover, communications and information flows are enabled by the use of a dedicated web portal.

The actual provision of repair and maintenance services is in charge of the Tenco assistance network (see Embedded Unit 1).

The logic of Tenco's Contract Hire delivery is also reported in Figure 51.

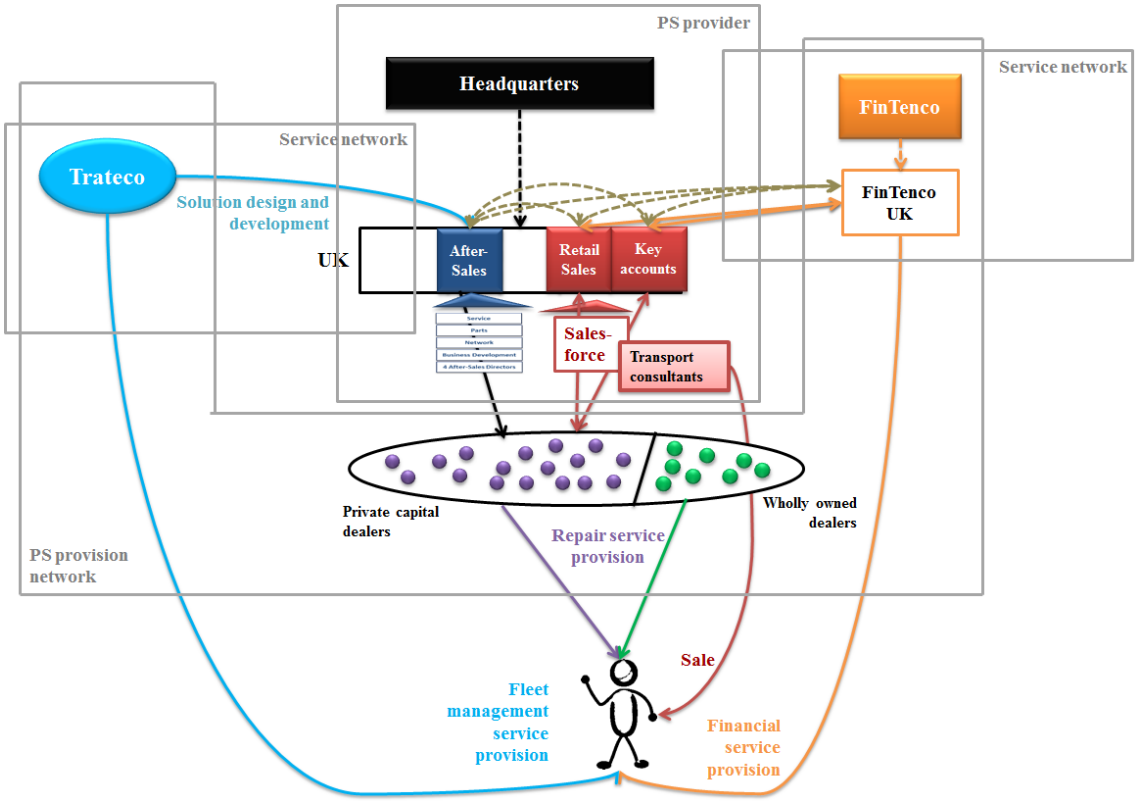


**Figure 51: Contract hire**

### 5.2.4 Within-case analysis

Table 72 represents the conceptual matrix of this case[23].

For the embedded units considered in this case, there are two variables that change: the PS Offering Focus and the Product Ownership.

#### *5.2.4.1 From a focus on the product to a focus on the customer's process*

Considering the units characterised by a product-oriented offerings (O.F.=1), the assistance network is the main partner. Competences on product are required and the content of exchange mainly refers to physical assets, information on product, as well as technical knowledge. Decisions are centralised on Tenco and there is a high level of control on the network through both measurement and reporting systems. Indeed, several KPI are monitored and are linked to a structured reward program. Every year these KPIs are redefined on the basis of the strategic priorities. The importance of an appropriate management of the assistance network is reflected internally on the presence of an After-Sales function and its role as profit centre.

[23] For a description of the matrix structure, see paragraph 5.1.5.

On the contrary, moving towards process-oriented solutions (O.F.=4, O.F.=5) demands new competences, related to the entire product life cycle from a customer's perspective (purchasing, owning and using the vehicle). Such competences are "bought" from external partners, that have these competences at the core of their business. The partners function both as service suppliers for Tenco and as direct service providers to the customer. As a consequence, Tenco acts as an aggregator of competences, sold to the customer by its sales-force. In particular, where commercial competences are involved, Tenco directly sales vehicles and services through its sales employees, without involving a dealership network. It lets the assistance franchise network of dealers to be just an after-sales franchise, purely focused on the provision of after-sales services and customer service, and the salesmen to approach the market with a homogeneous and structured approach. The need to commercialise services that impact on the customer's activities and processes pushed Tenco to improve the salesman capabilities of understanding customer's needs and of acting as a business consultant for the customer himself. This aspect was implemented through the provision of "transport consultant training" courses.

Finally, the involved resources are more intangible, based on human resource, information and knowledge.

#### *5.2.4.2 The change of the product ownership*

The shift of the vehicle ownership from the customer to Tenco basically requires financial competences and the related credit-risk management capabilities. These capabilities are brought to Tenco by the financial company of the group.

#### *5.2.4.3 Introducing a new aspect: the PS Offering Extent*

The fourth embedded units represents an integrated package of two different services: renting and R&M contract. This aspect is not depicted any variable of the conceptual model developed in Chapter 3. However it seems to be important and to influence a particular aspect of the PS provider, related to the integration of the involved internal functions. Indeed, the management of an solution composed by the integration of different services requires a better alignment of the actors involved (PS provider and PS provision network companies) and a higher coordination, reflected in a shared database and ICT tools to support communication and information flows between the involved

units. The same considerations can be applied to the R&M packages that include the fleet management module.

In order to contemplate this characteristics of a PS offering, a new variables should be introduced: the *PS Offering Extent*. As defined by Stremersch et al. (2001), it describes the integration degree of the components of a PS offering. It can range from unbundled (components are sold separately), to mixed bundles (components can be sold either in bundled or in unbundled offerings), up to bundled (components are sold in one offering). Although in the development of the conceptual model such variable was not considered relevant since it was mentioned by one publication only, the Tenco case study rises its importance. Consequently, it is introduced in the conceptual framework.

#### *5.2.4.4 The introduction of new services (Service Expansion)*

The introduction of new services (called *Service Expansion* in the model), no matter their specific characteristics, impacts on the internal organisation of Tenco and on the involved functions. Excluding repair and maintenance services that are provided "on demand" (in response to a customer's requirement), when new services are introduced, the Sales function is involved in the service business and is in charge to sell and promote the services to the market. The incentives given to salesmen are proportioned to the number of product and service contracts sold, with higher weights assigned to the service sale. Training programs are delivered to salesmen to improve their relational skills and their ability to understand customers' needs, in order to transform the sale force into "transport consultants". Moreover, customers' data collected through different service provision are used to segment the market and tailor the offerings on actual customers' characteristics and requirements by the Business Development area of the After-sales function, having Marketing roles.

As for the Truco case study, the variables considered in the conceptual model are constructs tied through casual relations.

Graphically, the impacts of changes of PS Offering focus (from product o customer's processes), Product Ownership (from customer to supplier), PS Offering Extent (from unbundled to mixed bundles) and the general introduction of new services (Service Expansion) are shown in Figure 52.

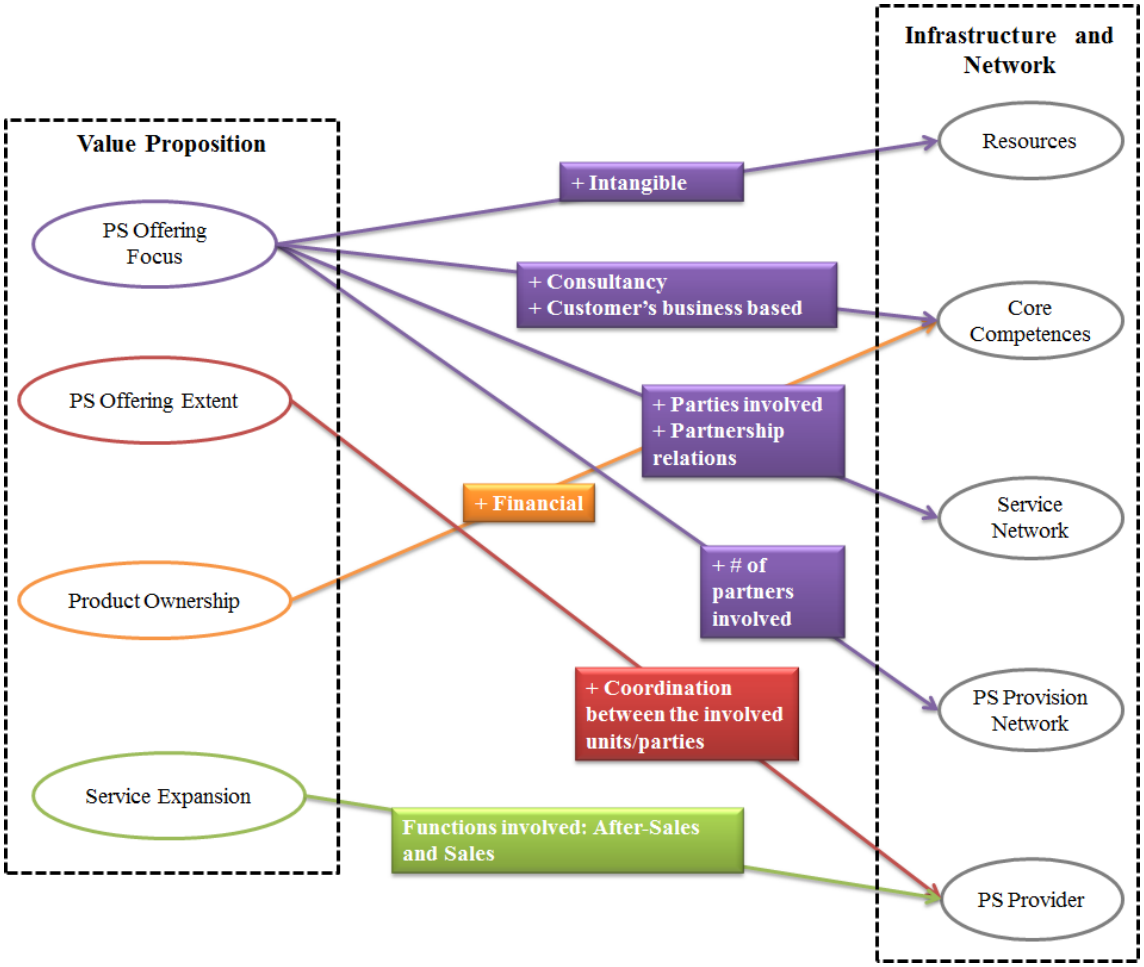


**Figure 52: Tenco - The research conceptual framework**

| | Repair services | R&M contracts | Fleet management | Contract Hire |
|---|---|---|---|---|
| *Competences* | | | | |
| Required competences | Technical on vehicles | Technical and commercial | Telematics and fleet management and customer data analysis | Technical, commercial and financial |
| Allocation of competences | Technical competences: external partner | iii. Technical: external partner<br>iv. Commercial: internally | i. Telematics and fleet management: external partner<br>ii. Customer data analysis: internally | i. Technical: external partners<br>ii. Commercial & financial: internal |
| *Resources* | | | | |
| Required resources | Technicians, spare parts, supporting tools, technical information. | Salesmen, technicians, spare parts, supporting tools, technical information. | ICT, software programs as information collectors and processors. | Sum of the resources required by each single service that composes the integrated package. |
| *Value Network Configuration – PS provider* | | | | |
| Internal involvement | After-Sales | Sales & After-Sales | Sales & After-Sales | Sales and After-Sales |
| Activities performed internally | Management of private capital (17) and wholly owned (51) dealers for the actual provision of the services | i. Salesmen (Tenco's employees) sell the contracts<br>ii. After-Sales: management of the assistance network | i. Sales: sale of the offering<br>ii. After-Sales: management of the relationship with the external partner and analysis of customer's data for new business development (training course) | i. Salesmen (Tenco's employees) sell the contracts (R&M + financial)<br>ii. After-Sales: management of the assistance network |
| Intra-firm relations | - | Loose relations between After-Sales and Sales | - | Close relations between After-Sales and Sales |
| Objectives& Responsibilities | After-Sales: Profit centre | i. Sales and After-Sales: Profit centre<br>ii. Monetary bonuses related to the number of contracts sold | i. Sales and After-Sales: Profit centre<br>ii. Monetary bonuses related to the number of contracts sold | i. Sales and After-Sales: Profit centre<br>ii. Monetary bonuses related to the number of contracts sold |

| *Value Network Configuration – Service and PS provision network* | | | |
|---|---|---|---|
| Partner(s) | Assistance network | Trateco | i. Assistance network for R&M provision<br>ii. FinTenco UK for financial service provision |
| Type of relationship | Strategic partner | Strategic partner | Strategic partners |
| Legal ties | Franchisee contracts / Ownership | - | i. Assistance network: Franchisee contracts / Ownership<br>ii. FinTenco UK: Same corporate group |
| Content of exchange | Spare parts, supporting tools, information, knowledge | Custmer's data | i. Assistance network: Spare parts, supporting tools, information, knowledge<br>ii. FinTenco UK: information and knowledge |
| Resource sharing infrastructure | Spare parts supply chain, catalogues, documentation, ICT, training centre. | Web portal | i. Assistance Network: Spare parts supply chain, catalogues, documentation, ICT, training centre.<br>ii. FinTenco UK: documentation and ICT |
| Decision style | Centralised on the company | Decentralised | Centralised on the company |
| Level of control | High direct control | Low | i. Assistance Network: High<br>ii. FinTenco UK: Low |
| Risk/Reward sharing and incentives | Monetary bonuses related to a set of KPIs (First Time Pass Rate, Roadside assistance and Preventive Maintenance Inspection)<br>- | - | Assistance Network: Monetary bonuses related to a set of KPIs First Time Pass Rate, Roadside assistance and Preventive Maintenance Inspection) |
| Geographical presence | Widespread on the territory | - | Assistance Network: Widespread on the territory |

**Table 72: The Tenco case study - main characteristics**

## 5.3 Case Study 3: Elmoby

### 5.3.1 The automotive sector and its sustainability challenge

In protecting the environment and creating more sustainable ways of using the earth's resources, the automotive industry plays a major role. From one side, there is a growing need for individual mobility, particularly in the emerging economies, and on the other side, trends such as rising fuel prices, technological innovation, changing consumer demands, increasing regulation, intense competition, are starting to create a rich soil for sowing the sustainability seed.

To meet the challenges brought by sustainability, the automotive industry is investing large R&D budgets in a variety of new technologies for propulsion, with a particular focus on:

- optimising internal combustion engines (ICEs);
- adapting drive-trains for alternative fuels (such as compressed natural gas – CNG, second generation biofuels, and hydrogen);
- developing propulsion systems based partially on electricity (hybrid power train);
- industrialising zero-emission (fully) electric vehicles (EV).

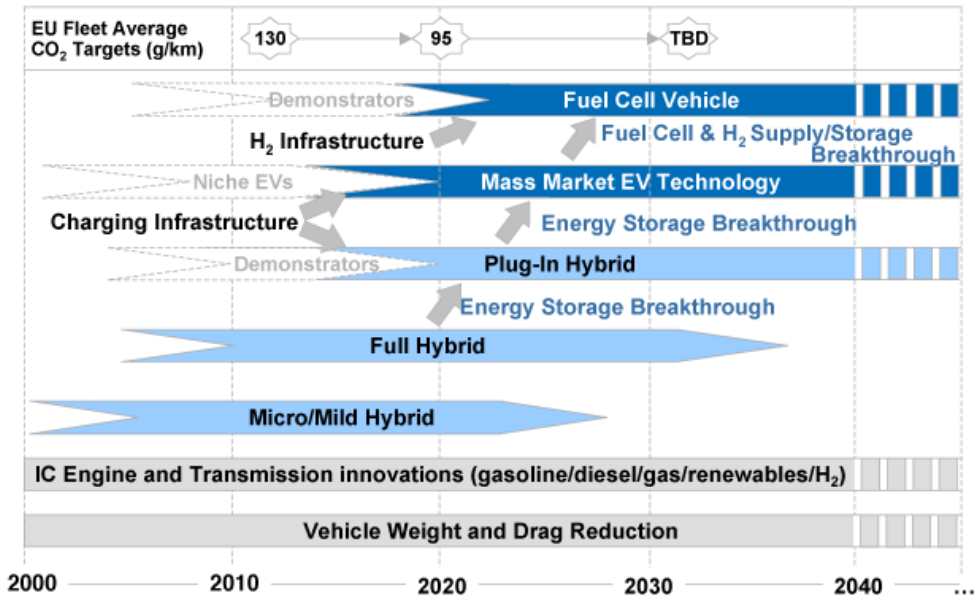


**Figure 53: The electrification path (NAIGT, 2009)**

This electrification path, shown in Figure 53, substantially cuts $CO_2$ emissions, but it will come at a high price, as demonstrated by a study performed in 2009 by the Boston Consulting Group (Book et al., 2009), shown in Figure 54.

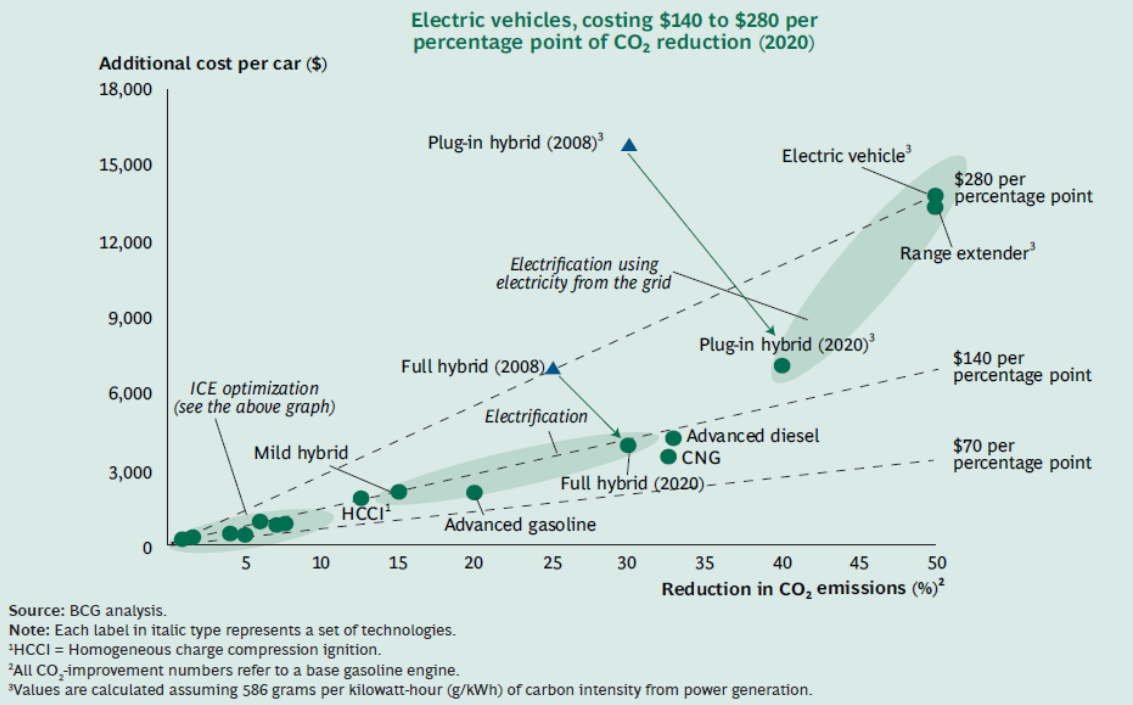


**Figure 54: The impact of different technologies on $CO_2$ emissions and on costs (Book et al., 2009)**

Even if leading companies understand this imperative and consider sustainability as an important competitive lever (Accenture, 2011), questions arise about how these additional costs will be distributed among the main stakeholders in the industry.

Focusing the attention on the OEMs, three issues emerged as significant (Book et al., 2009):

- ensuring access and building solid know-how across effective supply networks;
- offering consumers attractive value propositions;
- managing the high complexity of their R&D portfolios.

Regarding the first point, the most critical components for an electric car is its battery. Thus, OEMs are pursuing partnerships with battery suppliers, as shown by several

examples already in place (e.g. Toyota and Panasonic[24], Nissan North America and ABB[25]).

The second challenge is related to the necessity of a suitable infrastructure in place to operate and charge electric vehicles. To provide it, some OEMs have built partnerships with local institutions or power companies, such as Mercedes and Enel in Italy[26], Toyota and EDF in France[27], Nissan-Renault and RWE in Germany[28].

Finally, the management of an OEM's R&D portfolio becomes particularly crucial under the current financial crisis.

Therefore, the commercialisation of electric vehicles may need unconventional business models, with the involvement of several stakeholders, as demonstrated by the following case study.

### 5.3.2 The company

The third case company is part of an international group focused on the design, the production and the commercialisation of premium cars, buses, commercial vehicles and trucks. With its strong brands and a comprehensive portfolio of vehicles, the group is active in nearly all countries in the world. The product offering is completed through a variety of after-sales and financial services. Moreover, with the development of alternative drive systems, the group is the only vehicle producer investing in all three technologies of hybrid drive, electric motors and fuel cells, with the goal of achieving emission-free mobility in the long term.

The analysis was carried out in the Italian subsidiary of the group, hereafter referred to as Elmoby, where a pilot project was launched in 2010 to test the feasibility of a business model based on electric cars.

Through company visits and telephonic contacts, three managers from Sales, After-Sales and Finance functions were interviewed. Moreover, secondary sources of data, such as company documentation and corporate website, were used for triangulation.

[24] http://www.toyota.com/about/news/product/2010/01/11-1-NAIAS.html
[25] http://www.nissan-global.com/EN/NEWS/2012/_STORY/120118-01-e.html
[26] http://www.enel.com/en-GB/innovation/project_technology/zero_emission_life/mobile_sustainability/e-mobility.aspx
[27] http://www.toyota.com.cy/about/news_and_events/phv_strasbourg.tmex
[28] http://www.renault.com/en/capeco2/vehicule-electrique/pages/cooperations-et-partenariats.aspx

This case is composed by one embedded unit only, related to the launch of the new electric vehicle on the market, divided in two phases: the pilot project and then the introduction of the vehicle into the product portfolio.

### 5.3.3 The pilot project: Elmopro

Elmopro was a project jointly developed in Italy by Elmoby and Eleco, the first Italian electric provider. 100 customers, both companies and individuals, were selected among those who have applied on a specific website.

Under this pilot project, introduced in three Italian city in 2010 and lasted two years, Elmoby provided over 100 electrically powered vehicles (available only for the project), also taking care of their maintenance through three workshops of its assistance network (one per city). In order to provide a high level of the assistance service, the selected workshops were equipped with the suitable tools, and their technicians were properly trained through courses on the specific features of the new car.

On the other hand, Eleco was responsible for the development, implementation and operation of the infrastructure, including over 400 "smart" charging stations, in order to provide a safe, efficient and convenient service. Using Eleco's smart charging network, vehicles could be charged both at home (in a garage) or in a public environment, and the innovative remote network system, created by Eleco, allowed participants of the project to know where charging stations were located.

The electric cars were available at a special monthly rate, which included renting, routine maintenance, replacement vehicle cover and warranty for the 48-month duration of the project and fire and theft insurance cover, with an Elmoby buy back at the end of the contract. Additionally, for a fixed monthly fee (paid directly to Eleco), drivers could fill up with unlimited "clean" electricity at all the Eleco recharging points, either at home or in public places, including all installation and connection costs.

Aim of the pilot project was to test the reliability of the technical aspects, especially related to the battery and the interface with the charging infrastructure, as well as the customer acceptance of the new electric mobility. A close relationship between Elmoby engineering department and Eleco was (and is still) fundamental to overcome the found technical problems.

The success of this first trial pushed Elmoby to continue in this direction, introducing the electric car in the product offering and to rethink the business model behind this new vehicle.

### 5.3.4 Introducing the electric car in the catalogue

The introduction of the new electric vehicle in the current product portfolio entails that customers are not selected by the company anymore, but everyone has access to it. As for a car with a traditional combustion engine, Elmoby made available different solutions for its commercialisation: pure sale, financing, and leasing. However, no matter the type of solution chosen, the electric battery is always provided to the customers through a renting agreement, consisting in a monthly fee. The values assumed by each variable for this electric car offering (and battery renting) are shown in Table 66.

| Product Ownership | Product User | Product Decision Maker | PS Offering Focus |
|---|---|---|---|
| PS provider (battery) | Customer | Customer | Process |

**Table 73: Characteristics of Elmoby's offering**

Financial services (battery renting in this case), are provided to the customer by the Italian branch of Finelmoby, the financial company of Elmoby group. Finelmoby leases or finances more than one third of all vehicles produced by Elmoby Group worldwide. Working in close cooperation with the companies of the Group, Finelmoby, through its 39 branches, provides financial support to private and business customers, and Elmoby group's dealers. In Italy, Finelmoby has more than 230 employees serving more than 72.000 customers, with a portfolio of 1500k Euros. Even if Finelmoby is a separate and autonomous society from Elmoby, it is considered an internal business, underlying the close relationship between the two companies.

The financial contracts are sold to the customers by the sales-force, employed by the Elmoby dealer network. The network is composed by 80 private capital dealers and 2 wholly owned dealers. Internally, the Sales business unit, considered as a profit centre, develops and manages the dealer network, providing bonuses related to the number of vehicles, as well as service and financial contracts, sold. Finelmoby has a close relation

with the Sales function through the implementation of customers' data sharing processes and the use of a common database.

When a financial contract is signed, Finelmoby opens a credit with the dealer that sold the contract, that in turn opens a credit with the final customers. Finelmoby is responsible of back and front-office activities and the management of the customer during the entire contract (provide information, manage expiring contracts, claims, etc).

Traditionally, the technical assistance on the vehicle, excluding the battery, are provided by the workshops of Elmoby assistance network equipped with proper tools and instruments for repairing and maintaining the electric engine. So far, only three workshops are supplied with the appropriate equipment. The number of equipped workshop will grow in accordance with an increasing penetration of the electric car in the market. The overall Elmoby assistance network is composed by 270 private capital workshops, tied to the company through a franchise contract, and two wholly owned dealers (two societies of Elmoby group). Internally, the After-Sales business unit is in charge to manage the assistance network. It is responsible for profits and losses and incentives the workshops with monetary bonuses, based on the number of spare-parts sold and on the quality of service provision.

Repair and maintenance activities on the lithium-ion battery are provided by the battery supplier (Batteco) and its assistance network. Batterco is the automotive lithium-ion battery joint venture formed in 2008 by Elemoby's parent company and Chemco, one of the world's leading specialty chemicals companies. This choice derives from the high criticality of this component. Relying on the assistance network of a company specialised in electric batteries, Elmoby can ensure a higher service quality to its customers, and relieves its workshops of acquiring additional competences and tools. The assistance activities are provided through the mediation of Elmoby workshops: when a customer notices a problem with the battery, turns to an Elmoby workshop that, consecutively, signals the problem to Batteco and its network.

Regarding the charging infrastructure, Eleco continues in the installation of charging points. If a customer requires the installation of a charging station (called Wallbox) at home, Elmoby dealers act as an intermediary between the customer and Eleco, creating the contact between the two actors. Eleco is responsible for a first inspection at customer's place, proposing a bid, and installing the Wallbox. The charging process,

either through a home Wallbox or a public charging station, is only automatically activated when the personal ID is recognised, enabling a convenient, simple and secure billing at all times. Customers receive a single electricity bill from Eleco regardless of where and from which charging station operator they get the electricity for their vehicle. Finally, Eleco is also responsible for the operations, supply of electricity, central system control and maintenance of the infrastructure.

Figure 55 summarises how Elmoby manages and provides its electric vehicles.

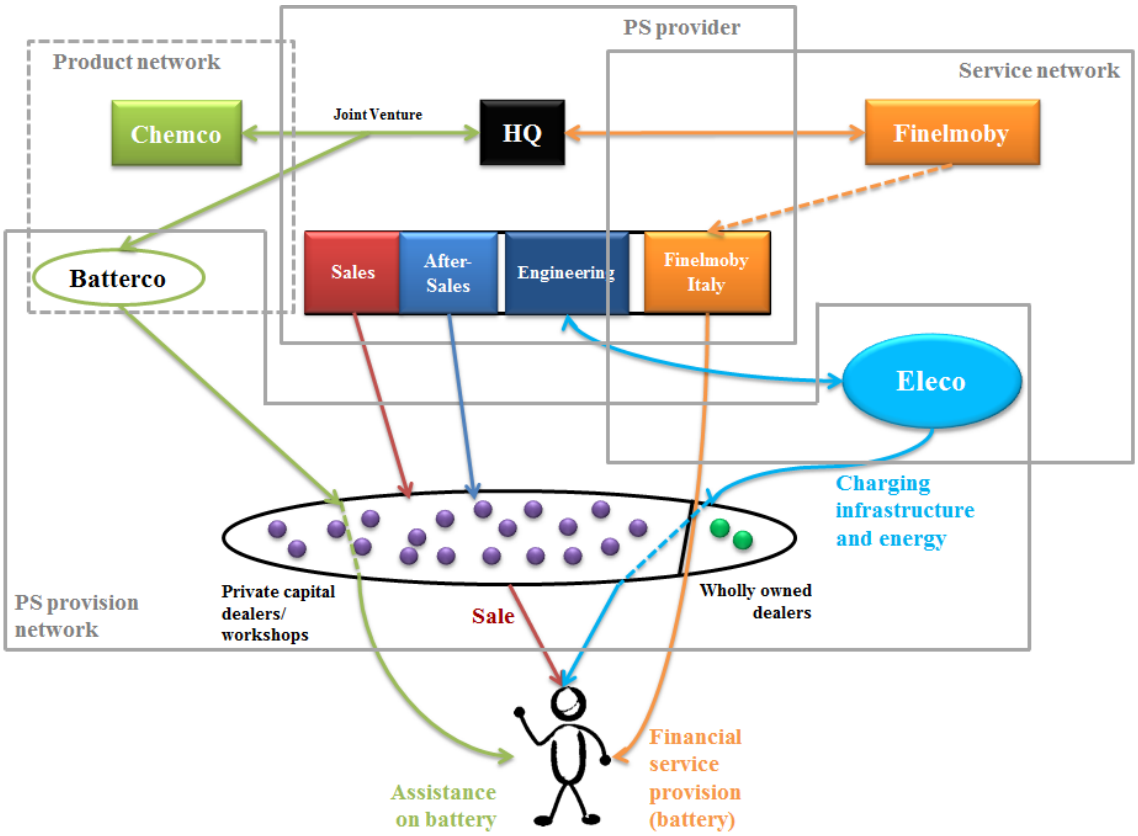


**Figure 55: The provision of electric vehicle**

### 5.3.5 Within-case analysis

Through this case study, a particular renting solution is described and analysed. Table 74 represents the conceptual matrix[29].

For the embedded unit considered in this case, there are two variables of interest: the PS Offering Focus and the Product Ownership.

[29] For a description of the matrix structure, see paragraph 5.1.5.

#### *5.3.5.1 The change of the battery ownership*

While the car is sold with a traditional formula by dealer salesmen, its critical component (battery) is provided to the customer through a renting solution. It means that Elmoby retains the ownership of the battery. Financial competences are brought by a corporate partner, specialised on the provision of financial services. Also the financial partner is part of the PS provision network since, after the sign of the contract, it builds a direct relation with the customers for the entire length of the contract. The contract is sold to the customer by dealers' employees. Even if the financial company is an independent firm, it is considered as an internal business unit, having close relations with the Sales function and sharing customers' data through a common database.

#### *5.3.5.2 The focus on customer's processes*

Since the ownership of the battery is not transferred to the customer, Elmoby is responsible for providing its use and ensuring its reliability. The battery are serviced directly by the producer assistance network that, beyond being a product-partner, it becomes also a fundamental actor of the PS provision network. The relation between the battery supplier and the customers is mediated by the assistance network.

The charging infrastructure is built and managed by another partner, competing in the electricity provision sector. The direct relation between this company and the customer is opened by the assistance network of the PS provider.

Thus, the PS provider, supported by its sale and assistance network, acts as a coordinator and a mediator of different partners that bring their own core competences to the business and to the customers. These competences are related both to the product (battery) itself and to its use (charging activities). Moreover, these coordination activities require sharing information and knowledge, especially customers' data.

Finally, the required competences are both tangible and intangible. The first one refers to the charging infrastructure that was built, necessary for the fruition of the electric mobility. The second one are related to the relevance of human resources and information.

#### *5.3.5.3 Introducing a new aspect: the PS Offering Technical Requirement*

This case study represents how services can be used by an OEM company to propose a new technology to the market. Since the electric car technology is still in a development

phase, the Engineering department needs to be involved in improving product technical features and, as a consequence, rising the quality of the provided service. The weight of technological product aspects can be depicted through the use of a new variable, namely *PS Offering Technical Requirement*, that measure whether the introduction of a new service requires new specific technical product characteristics. In this case there are two important technical features. The first one is related to the lithium-ion battery, for which the product supplier (Batterco) is directly involved in providing assistance to the customers. The second one is associated to the charging infrastructure network, where the Engineering department collaborates with Eleco to design cars that can communicate with the charging stations.

Also this case study confirms the need to transform the variables considered in the conceptual model into constructs tied through casual relations.

Graphically, the impacts of PS Offering focus (customer's processes), Product Ownership (from customer to supplier) PS Offering Technical Requirement and are shown in Figure 56.

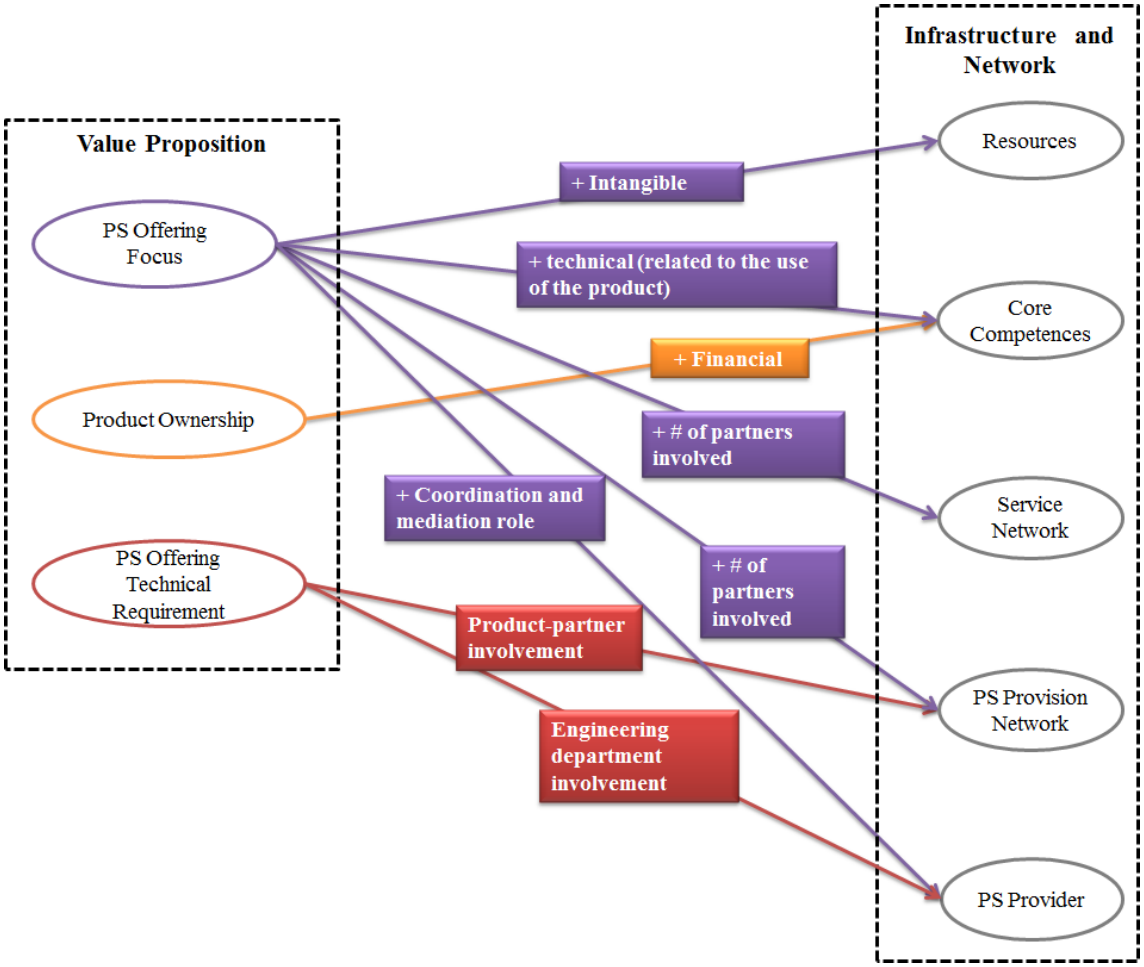


**Figure 56: Elmoby - The research conceptual framework**

| | **Electric mobility** |
|---|---|
| *Competences* | |
| Required competences | Technical (car, battery, energy infrastructure development and management), financial |
| Allocation of competences | External partners |
| *Resources* | |
| Required resources | Salesmen, finance-men, charging infrastructure, ICT, information and knowledge. |
| *Value Network Configuration – PS provider* | |
| Internal involvement | Sales, After-Sales and Engineering department |
| Activities performed internally | Development and management of sale and assistance network (dealers and workshops) and "collector" of competences |
| Intra-firm relations | Coordination of the involved functions through information flows and shared databases (especially customers' data) |
| Objectives& Responsibilities | Since the introduction of the electric car is still in an early stage, no bonus or incentive schemes have been developed yet. |
| *Value Network Configuration – Service and PS provision network* | |
| Partner(s) | Assistance network, Batterco (as joint venture between Chemco – chemical company – and HQ), Finelmoby Italy (financial company), Eleco (electric provider) |
| Type of relationship | Strategic partnerships |
| Legal ties | Assistance network: franchisee contract<br>Batterco: Joint venture with the parent company<br>Finelmoby: same corporate group<br>Eleco: no legal ties |
| Content of exchange | Assistance network: spare parts, tools and technical knowledge on product<br>Batterco: battery<br>Finelmoby and Eleco: customer's data and knowledge |
| Resource sharing infrastructure | Assistance network: spare parts supply chain, catalogues, documentation, ICT, training centre<br>Batterco: product supply chain, ICT<br>Finelmoby and Eleco: ICT |
| Decision style | Centralised for the assistance network, decentralised for the other partners |
| Level of control | High direct control on the assistance network, low control for the other partners |
| Risk/Reward sharing and incentives | Under definition. |

| | |
|---|---|
| Geographical presence | Assistance network: 3 workshops<br>Other partners: - |

**Table 74: The Elmoby case study - main characteristics**

## 5.4 Case Study 4: Rentco

### 5.4.1 Financial services and automotive industry

Leasing and renting of vehicles have a long tradition in the automotive industry: in Europe, only one car in four is purchased in cash, while three of four are supported either by financing or by long-term leases/rents (Leaseurope and A.T. Kearney, 2009).

As shown in Table 75, considering the automobile business value chain, financing activities count for 38% of the total revenues, and 57% of the total profit.

| | | **Sales** | **Profits** |
|---|---|---|---|
| Industrial activities | Conception (R&D, product strategy) | 39% | 8% |
| | Purchasing | | |
| | Production (Optimisation of production capacity, cost cutting) | | |
| | Sales of new cars (Pricing and incentives policy, international growth) | | |
| | After-Sales (Spare parts, maintenance, etc) | 12% | 30% |
| Financing activities | Financing / Leasing | 30% | 46% |
| | Insurance and warranties | | |
| | Other services (fleet management) | | |
| | Sales and financing of used cars | 8% | 11% |

**Table 75: Sources of profit in the automobile value chain (IXIS CIB, 2006)**

Thus, besides after-sales services, also financial services are vital commercial tools to support and promote the OEM's sales both in terms of volumes (customers purchasing vehicles through credit or leasing/renting solutions renew their cars more frequently) and value (higher transaction price, more options and associated services included in packages), as demonstrated by this final case study.

### 5.4.2 The company

Presents in 160 countries, Carco Group is one of the top players in the worldwide automotive industry with two strong, consistent and complementary brand identities. Design, production and commercialisation of automobiles is the core business of the Group. However, it is complemented by a series of activities such as vehicle financing, automotive equipment production and transport and logistics services.

Object of this case study is the Italian subsidiary of the group, hereafter referred to as Carco, that acts as national importer of Cargo's vehicles and whose product offering is complemented with a range of services.

### 5.4.3 The Value Proposition

As described in Table 76, there are two PS offerings investigate through this fourth case study. The first one is related to the provision of a leasing service, while the second one to a long term renting solution.

| | **Service** | **Service Description** |
|---|---|---|
| 1 | Financial leasing | Long term contract, under which the vehicle property is not transferred to the customer, who uses the car under the payment of a monthly fee for a fixed period. |
| 2 | Long term rental | Integrated offering that includes a rental agreement, insurance, repair and maintenance contract and an extended warranty. |

**Table 76: Carco's selected offering**

The two offerings refer to the use-oriented category, as shown in Table 77.

| | **Product Ownership** | **Product User** | **Product Decision Maker** | **PS Offering Focus** |
|---|---|---|---|---|
| 1, 2 | Supplier | Customer | Customer | Process |

**Table 77: Characteristics of Carco's selected offering**

### 5.4.4 The embedded units

#### *5.4.4.1 Financial leasing*

The financial leasing service is provided by Carco through Fincarco, the captive financial company of Carco's group. With its national subsidiaries, Fincarco operates as credit institution for the companies of the group. In particular, it provides a complete range of financial services related to automobile sales to three types of clients, namely: i) individuals, ii) companies, and iii) Carco's dealership networks. Even if Fincarco is a separate and autonomous society from Carco, it is considered an internal business, underlying the close relationship between the two companies. This last aspect is

underlined by the systematic promotion of those contracts by Carco's marketing activities.

Financial leasing contracts are sold to the customers by the Carco's dealer network. The latter is composed of 150 independent dealers (most of them are both dealers and workshops), linked to the company through a franchisee contract. The salesmen are incentivised to sell financial (and service) contracts through monetary bonuses related to the number of contracts sold. Internally, the Sales function, that operates as a profit centre, manages the dealer network, defining sale targets and controlling their fulfilment.

Afterwards, Fincarco is responsible of back and front-office activities and the management of the customer during the entire contract (provide information, manage expiring contracts, claims, etc).

At the end of the contract, the customer can decide either to become the actual owner of the car or to buy another leasing contract.

Figure 57 summarises how Carco manages and provides financial leasing services.

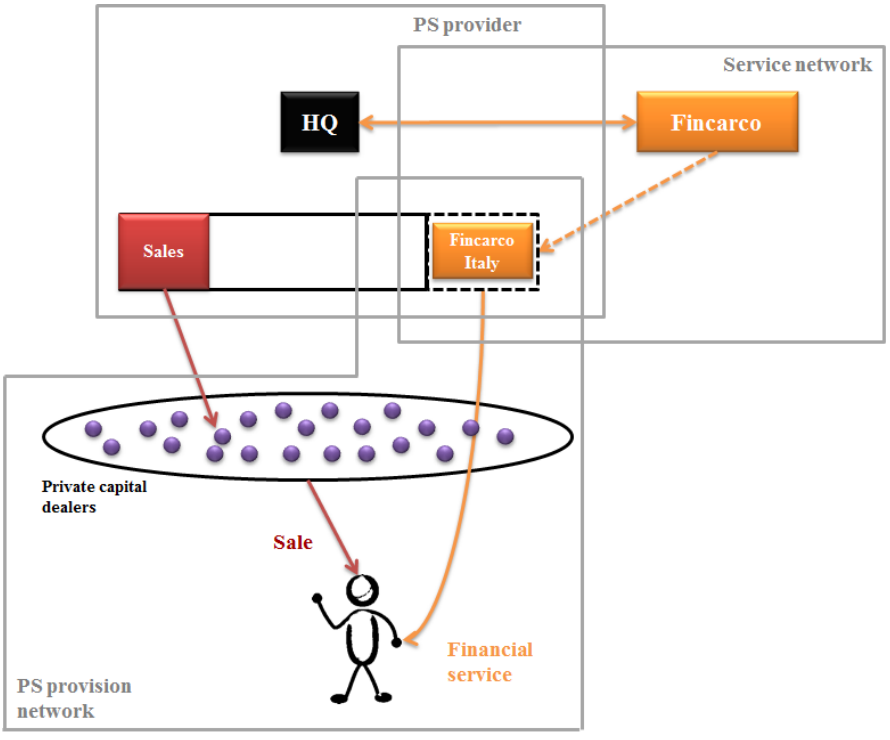


**Figure 57: Financial leasing**

#### *5.4.4.2 Long term renting*

Long term renting solutions are sold to the customers by Carco salesmen as an integrated package of different services, product-based (repair and maintenance, tyres substitution), process-based (insurance and fuel card) and use-oriented (renting). The sales-force is trained to be able to understand the customer's business, operations and balance sheet in order to sell the best solution. As already mentioned, the dealer network is internally managed by Carco's Sale function.

The renting service is provided by Carco through Rentcarco, a totally owned company by Fincarco Italy. Operating in the Business to Business (B2B) segment, Rentcarco was founded in 2008 specifically to provide long term renting solutions. Short term renting services are not delivered. As for Carco, it is considered an internal business unit. In particular, Rentcarco buys the car directly from Carco and makes it available to the customer, under the payment of a monthly fee that includes not only the use of the vehicle, but also several associated services related to the process of use (repair and maintenance activities, insurance, tyres substitution and fuel card). At the end of the contract Fincarco sells the car back to Carco, that introduces the vehicle in the used market.

Insurance services are provided by Fincarco through contracts with external insurance companies (Insuco in Figure 58).

Repair and maintenance services and tyres replacement are provided through the Carco's assistance network. It consists of 530 authorised workshops, tied to Carco though a franchisee contract. Bonuses are delivered to the workshops based on the number of spare parts sold and the level of customer satisfaction. Internally, the assistance network is managed and developed by the After-Sales function, responsible for profits and losses. It comprises three areas:

- Service, dealing with warranties, maintenance contracts, services, customer complaints, technical support, training, documentation and product monitoring;
- Parts, responsible for the spare parts' business;
- Network, interface between Carco and the network, responsible for dealer development and standard definition.

The fuel card is the inclusion of fuel consumption in the monthly fee. It is calculated on the basis of the average consumption and the miles range covered by the contract. Any differences that might occur between the estimated and the actual value is then covered. Since this service is the result of a partnership of Carco with Fuelco, one of the leading petrol company, refuelling must be done at petrol stations of Fuelco's network only. The different internal and external actors are coordinated by the After-Sales function through the use of ICT tools (web-portal) and shared repositories and databases.

The graphical representation of long term renting service provision is illustrated in Figure 58.

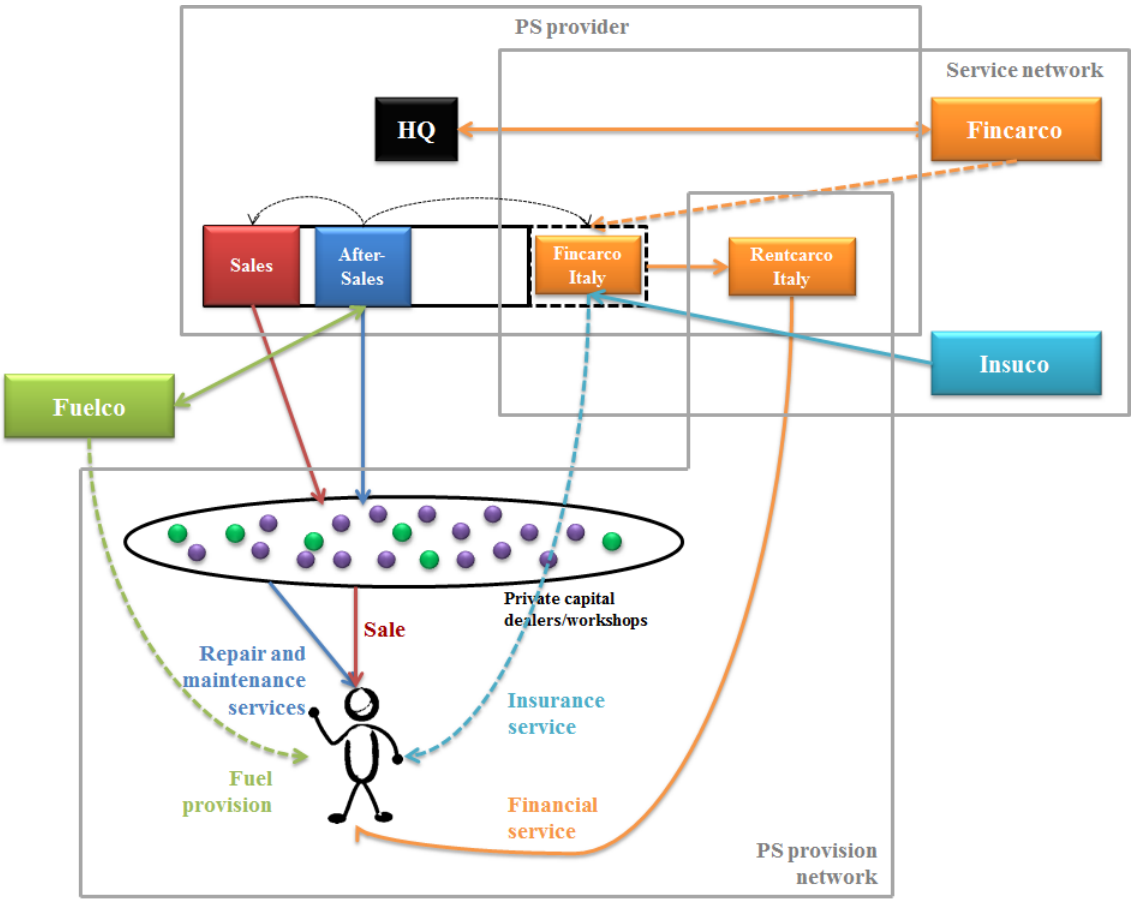


**Figure 58: Long term renting**

### 5.4.5 Within-case analysis

Through this case study, two financial solutions are described and analysed. Table 78 represents the conceptual matrix[30].

[30] For a description of the matrix structure, see paragraph 5.1.5.

In particular, two are the conceptual model variables of interest: the PS Offering Focus and the Product Ownership.

#### *5.4.5.1 The change of the vehicle ownership*

With both solutions, the ownership of the car is transferred from the PS provider to the financial partner. The latter is a captive finance company, belonging to the same corporate group, specialised on the provision of financial services. This firm plays two roles: supporting the PS provider with its financial competences (service network), and managing a direct relation with the customers for the entire length of the contract (PS provision network). The contract is sold to the customer by dealers' employees, who actually build the relationship with a customer. Even if the financial company is an independent firm, it is considered as an internal business unit.

#### *5.4.5.2 The focus on customer's processes*

The analysed PS offerings, focused on customer's process and business, demand new competences, related to the entire product life cycle from a customer's perspective (purchasing, owning and using the vehicle). While technical competences required for the provision of R&M services (included in the long term renting as integrated package) are available through the assistance network, other types of capabilities are taken from external partners, that have these competences at the core of their business. The partners can have two distinct role: service suppliers for Carco and direct service providers to the customer. From this perspective, Carco acts as an aggregator of competences, sold to the customer by its dealer sales-force. The commercialisation of services that impact on customer's activities and processes is a stimulus for Carco to improve the salesman capabilities of understanding customer's needs and of acting as a business consultant.

Finally, for product-based services (R&M) the required resources are a mix of tangible (for example spare parts and tools) and intangible (technicians and product knowledge) elements, for process-based offerings the involved resources are basically intangible in terms of human resources (salesman for contract sale, financial experts for financial service provision), knowledge and information.

#### *5.4.5.3 Introducing a new aspect: the PS Offering Extent*

The second embedded units represents an integrated package of several different services: renting, R&M contract, tyres substitution, insurance and fuel card. As for the

Tenco case study, this aspect can be depicted by a new first order variable: the PS Offering Extent. With the creation of an integrated package of different services, Carco has implemented ICT tools and shared databases to improve the communication and information flows both intra- and inter-firm. Even if more units and companies are involved, the After-sale function plays a central role as system integrator.

#### *5.4.5.4 The introduction of new services (Service Expansion)*

The introduction of new services (called *Service Expansion* in the model), no matter their specific characteristics, impacts on the internal organisation of Carco and on the involved functions. In particular, the Sales function is in charge to sell and promote the service contracts to the market and represent the first contact point with the customers, while the After-Sales function manages the assistance network and the external partners. Both the functions are considered profit centres, responsible for profits and losses.

As for the other case studies, the variables considered in the conceptual model are constructs tied through casual relations.

Graphically, the impacts of PS Offering Focus (customer's processes), Product Ownership (supplier), PS Offering Extent (from unbundled to mixed bundles) and the general introduction of new services (Service Expansion) are shown in Figure 59.

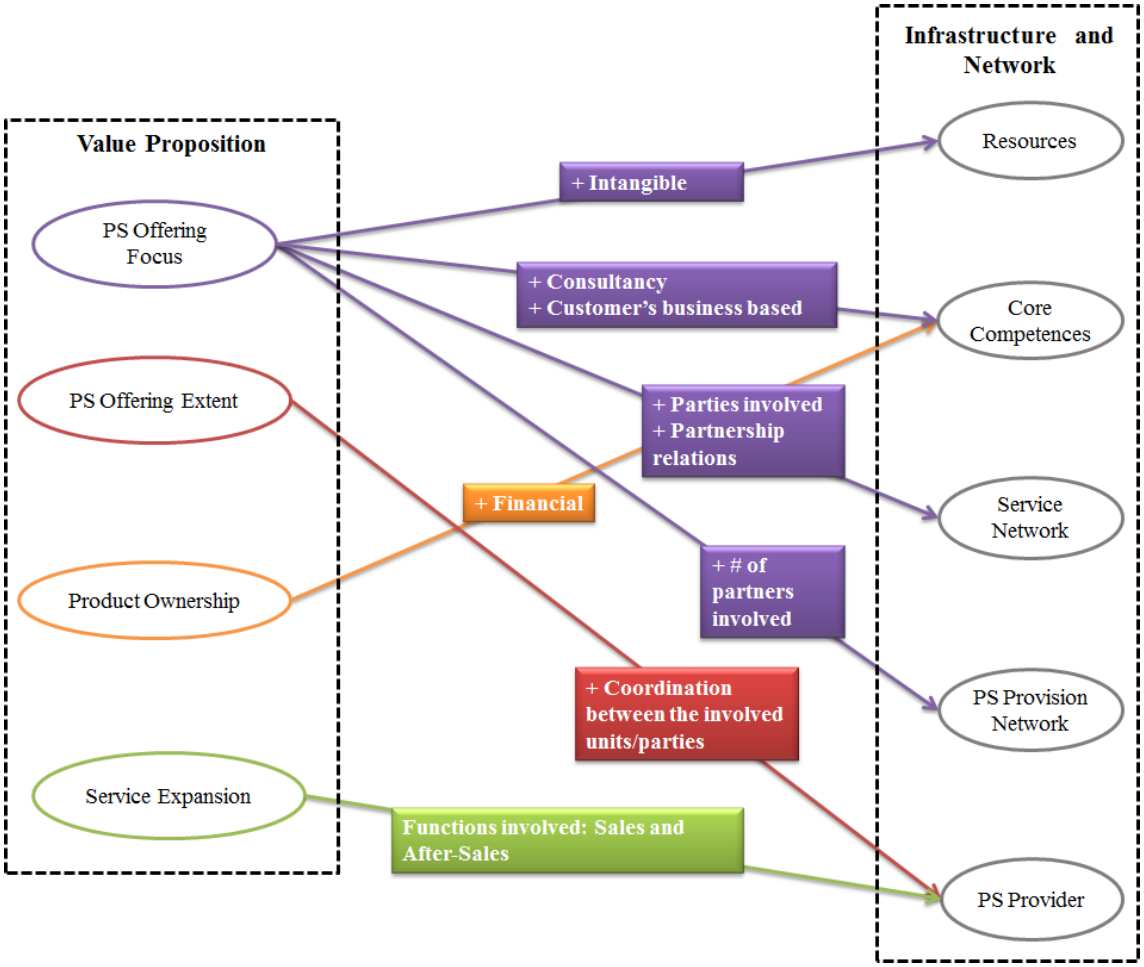


**Figure 59: Carco - The research conceptual framework**

| | Financial leasing | Long term renting |
|---|---|---|
| *Competences* | | |
| Required competences | Financial | Financial, technical, commercial, insurance-based |
| Allocation of competences | Financial company (external partner) | i. Financial: financial company<br>ii. Technical: assistance network<br>iii. Commercial: sale network<br>iv. Insurance-based: insurance company |
| *Resources* | | |
| Required resources | Information, knowledge, human resources | Technicians, salesmen, finance-men, spare parts, supporting tools, information, knowledge (sum of the resources required by each service composing the package). |
| *Value Network Configuration – PS provider* | | |
| Internal involvement | Sales | Sales and After-Sales |
| Activities performed internally | Management of the sale network (dealers) | i. Sales: Management of the sale network<br>ii. After-Sales: management of the assistance network (workshops) and of the external partner |
| Intra-firm relations | - | Close relations between After-Sales and Sales |
| Objectives& Responsibilities | Profit centre | Profit centres |
| *Value Network Configuration – Service and PS provision network* | | |
| Partner(s) | Sale network and financial company (Fincarco) | Sale network, assistance network, Fincarco (division Rentcarco), Fuelco, Insuco |
| Type of relationship | Strategic partner | Strategic partners |
| Legal ties | Franchisee contracts | i. Franchisee contract with sale and assistance network.<br>ii. Fincarco: company belonging to the same corporate group<br>iii. Fuelco and Insuco: - |
| Content of exchange | Information and knowledge | i. Assistance Network: Spare parts, supporting tools, technical information and knowledge.<br>ii. Sale network / Fincarco / Fuelco / Insuco: information and knowledge |
| Resource sharing infrastructure | ICT | i. Assistance Network: Spare parts supply chain, catalogues, documentation, ICT, training centre. |

| | | |
|---|---|---|
| | | ii. Sale network / Fincarco / Fuelco / Insuco: documentation and ICT |
| Decision style | Centralised | i. Centralised for sale and assistance network and for Fincarco.<br>ii. Decentralised for the other partners |
| Level of control | High | i. High for sale and assistance network and for Fincarco (considered an internal business unit)<br>ii. Low for the other partners |
| Risk/Reward sharing and incentives | Bonus to salesmen related to the number of contract sold | Bonus to salesmen related to the number of contract sold<br>Bonus to the dealers related to the number of spare parts sold and the level of customer satisfaction |
| Geographical presence | Widespread on the territory | Sales and assistance network: widespread on the territory |

**Table 78: The Carco case study - main characteristics**

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# 6 Cross-case analysis and discussion of findings

As demonstrated by the case studies, firms are likely to have services in more than one position along the PS continuum, having different characteristics. For example, companies offer services that relate not only to the product but also to the customers' activities and processes, including leasing and renting agreements, training, fleet management and customer assistance. This simultaneous coexistence of several service types in the same firm poses substantial challenges to understand how to manage a heterogeneous PS portfolio and what are the differences compared to a "business as usual" product-centred situation. As a matter of fact, to the evolution of the PS offering towards higher levels of *servitization* should correspond an evolution of the PS provider organisation, competences, resources and network, in a coherent, structured and consistent fashion.

Using as starting point the conceptual model developed in Chapter 3, in particular the logical statement that links Customer Value Proposition and Infrastructure and Network, and on the basis of the within-case analyses presented in the previous chapter, 12 propositions that describe how the different PS offering dimensions need to be differently managed by the PS provider are presented in the following paragraphs.

## 6.1 The competencies' evolution and their allocation

A manufacturer that moves into the service realm needs to develop or acquire new competences, depending on the type(s) of offerings introduced in its product portfolio (Baines et al., 2010; Brady et al., 2005; Cook et al., 2006). In particular, as demonstrated by all the case studies, product-based services (such as repair and maintenance and telematics) require technical competences on the product and on its components. Since OEMs already have an intimate understanding of the product they have designed and developed, they are well placed to provide services to inspect, maintain and upgrade a vehicle during its operational life (Davies et al., 2006). Given

that the involved capabilities[31] for such offerings are close to the traditional core competences of a PS provider, product-based services are managed and delivered directly by the company or through its assistance network.

The introduction of offerings characterised by a focus on how the customer uses the product involves two different categories of capability. On the one hand, it is necessary to understand customer's activities and processes involved in owning and using the product, through the development of consultancy competences (Davies et al., 2006; Shet and Sharma, 2008; Le Meunier-FitzHugh et al., 2011; Liu and Leach, 2001; Sharma et al., 1999). It is particularly evident in the Tenco case, where consultancy capabilities are developed internally, through proper training programs delivered to the sales force (directly employed by the PS provider) to become "transport consultants". On the other hand, specific competences related to each specific service are required to complement PS provider's core competences on product (for example fleet management competences for fleet management services or educational competences for training service). Since the desired capabilities are not strictly adjacent to PS provider's traditional competences, in most of the cases, they are brought by external partners, that have such competences at the core of their business. In the particular case of offerings that are also characterised by a shift in product ownership (leasing and renting solutions), financial and risk management competences become essential (Davies et al., 2006). For the investigated companies, even if the financial partner is an independent firm, it belongs to the same corporate group and it is considered as an internal business unit.

[31] The terms capability and competence are used interchangeably (Hamel Prahalad, 1992)

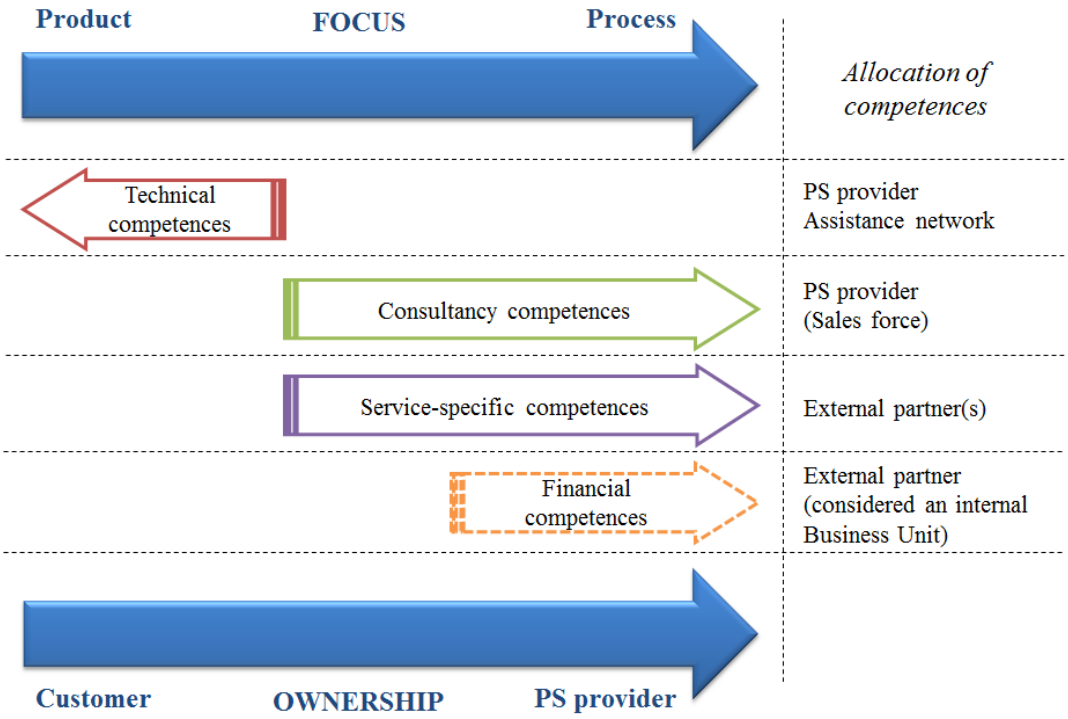


**Figure 60: The evolution of the required competences**

Therefore, the PS provider, moving from a focus on the product to a focus on the process, does not need to transform its traditional core competences, but essentially to expand them into the consultancy domain. In addition, the specific capabilities required by each service are brought by external companies.

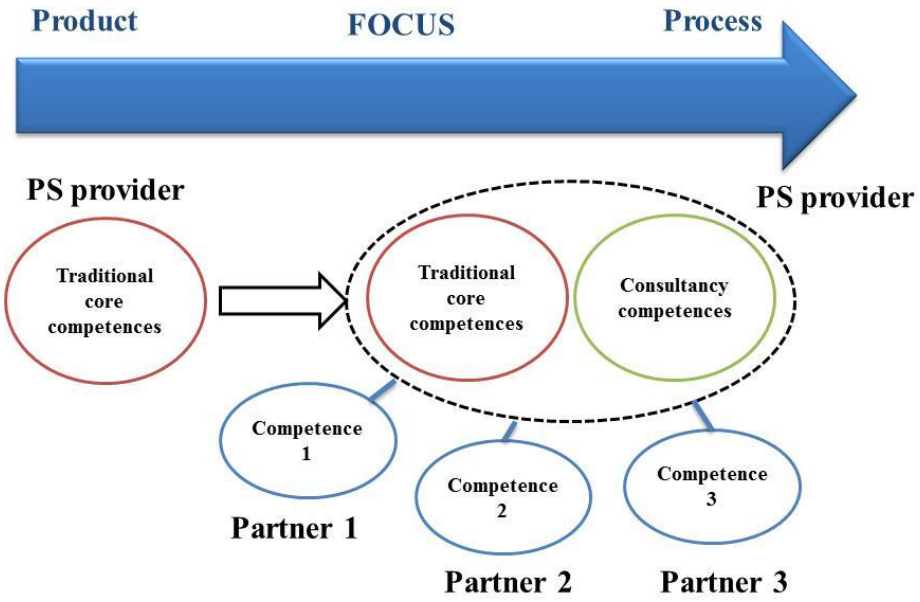


**Figure 61: The evolution of PS provider's core competences**

As a result, the initial logical statement[32] "*The servitisation level of the Customer Value Proposition is related to: […] iv) knowledge-based competences*" can be rephrased and exploded into seven propositions, that depict the different impacts that the Value Proposition variables have on competences and on how they are allocated:

**P1a**: Offerings focused on the product are related to traditional technical competences on the product.

**P1b**: Offerings focused on the product are delivered directly by the PS provider, generally with the support of its assistance network.

**P2a**: The shift of the PS offering focus from product to process requires consultancy capabilities.

**P2b**: The shift of the PS offering focus from product to process involves the transformation of salesmen into consultants who are able to understand customer's activities and processes.

**P3a**: The shift of the PS offering focus from product to process entails an increasing need of specific competences related to the provided services (service-specific competences).

**P3b**: The shift of the PS offering focus from product to process entails the involvement of external partners.

**P4**: A change of product ownership (from the customer to the PS provider) requires the development of financial competences.

[32] See Paragraph 3.3.2.2

## 6.2 The PS provider's evolution

As a heritage of the past, After-Sales is the organisational unit responsible for firm's technical support activities, with a central role in providing and managing product-focused offerings. In all the case companies, the After-Sales function (or Customer Service business unit for Truco) is at the same hierarchical level as product functions and it is not considered a cost- but a profit-centre, with its own identity and responsibility on profits and losses (Cook et al., 2006; Oliva and Kallenberg, 2003; Sawhney et al., 2004; Gebauer et al., 2005). Moreover, After-Sales not only controls technical support activities, but also manage the processes related to the spare parts business (pricing, logistics and delivery).

However, traditional after-sales services (for example repair and maintenance, inspection and diagnosis, extended warranties, etc.) are only one type of the potential services that a manufacturing company can potentially offer to its customers since the entire life cycle of a product has many pockets of value (Allmendinger and Lombreglia, 2005). Similarly, the After-Sales function is only one of the functions involved in the service provision, even maintaining a strong importance, and it must not be perceived as isolated from other organisational functions (Neu and Brown, 2008; Storbacka, 2011; Tuli et al., 2007; Windahl and Lakemond, 2006). In particular, the Sales function plays a fundamental role in the service realm. Traditionally, the Sales function refers to the organisational unit in charge to sell (directly as in the Tenco case, or through a dealer network as for the other three companies) the firm's traditional product offering. With the introduction of new services in the portfolio, generally sold through the same sales channel as the product, the Sales function holds both product and service responsibilities, and the salesmen become the first customer-provider interface also for the service domain. In order to push the sales force to promote and sell services to the customers, all the companies show the presence of a bonus schemes, where a portion of the available incentives are related to the number of service contracts sold. Besides Sales, also the Marketing function (or Business Development) has an important role not only in promoting new offerings to the market (Elmoby), but also in understanding market's needs and segmenting customers, with the support of operational information and data from the After-Sales function (Truco and Tenco).

Even if there are information flows between such units, these functions work independently, with informal coordination activities. However, as the extent of the Value Proposition shifts from unbundled to bundled offerings, the need of formal synchronisation increases (Johnstone et al., 2008), through cross-functional information and communications flows (Li, 2011; Song et al., 1997; Antioco et al., 2008) and shared databases containing customers' data. Therefore, Sales, After-Sales and Marketing function should work closely together, ideally in a symbiotic relationship, where:

- Sales is the first contact point with the customer and "opens" the relationship;
- After-Sales is responsible for service provision, either directly (managing the assistance network) for product-based offerings, or indirectly (managing the partners, as will be discussed in the next paragraph) for process-based offerings;
- Marketing (or Business Development) is in charge to collect data from Sales, After-Sales, and directly from the customer, in order to understand customers' needs, segment the market and support service design and development.

The autonomy and independence of the service business builds momentum, but it must not lose the critical points of contact with the product business (Baveja et al., 2004; Neu and Brown, 2005). First of all, service activities provide access to operational information of products, which can be used to improve the development and the quality of following product generation (Goh and McMahon, 2009; Abramovici and Lindner, 2011). As shown in the Truco case study, the Engineering department can benefit from feedback data on product quality, collected by the After-Sales and Marketing functions, not only through the assistance network, but also through telematics instruments, installed on the vehicle for providing telematics and fleet management services. Moreover, the Engineering department is involved in designing technical features that allow the provision of some services, especially the ones based on telematics tools. This last aspect is demonstrated by the Truco case (where a headquarters perspective was embraced) for the services that requires new technical product characteristics, and for the Elmoby case, where service is a means to promote a new technology.

When financial services that impact on product ownership are introduced (see Tenco, Elmoby and Carco), a new function is established. For the analysed cases (and in general for the automotive sector), the financial business unit is actually an external

company, belonging to the same corporate group. However, its integration in the PS provider business is so significant that its autonomy is only a legal issue.

As discussed in Paragraph 6.1, a process-focused offering requires competences related to each specific service, that in most of the cases are brought by external partners. Consequently, service provision activities do not involve only the After-Sales function and other internal entities, but takes also into account the possible roles of various third-parties actors in the PS value network. The "virtual" sum of the different functions and partners involved in service design, provision and management represents the *Service Organisation* (Gebauer et al., 2005), depicted in Figure 62. As a virtual enterprise (Camarinha-Matos and Afsarmanesh, 2004), the involved actors bring complementary core competencies without the creation of a new legal entity, where the PS provider hold the focal position and acts a system integrator (Davies et al., 2007). Inter-firm relations between the service parties will be discussed in the next paragraph.

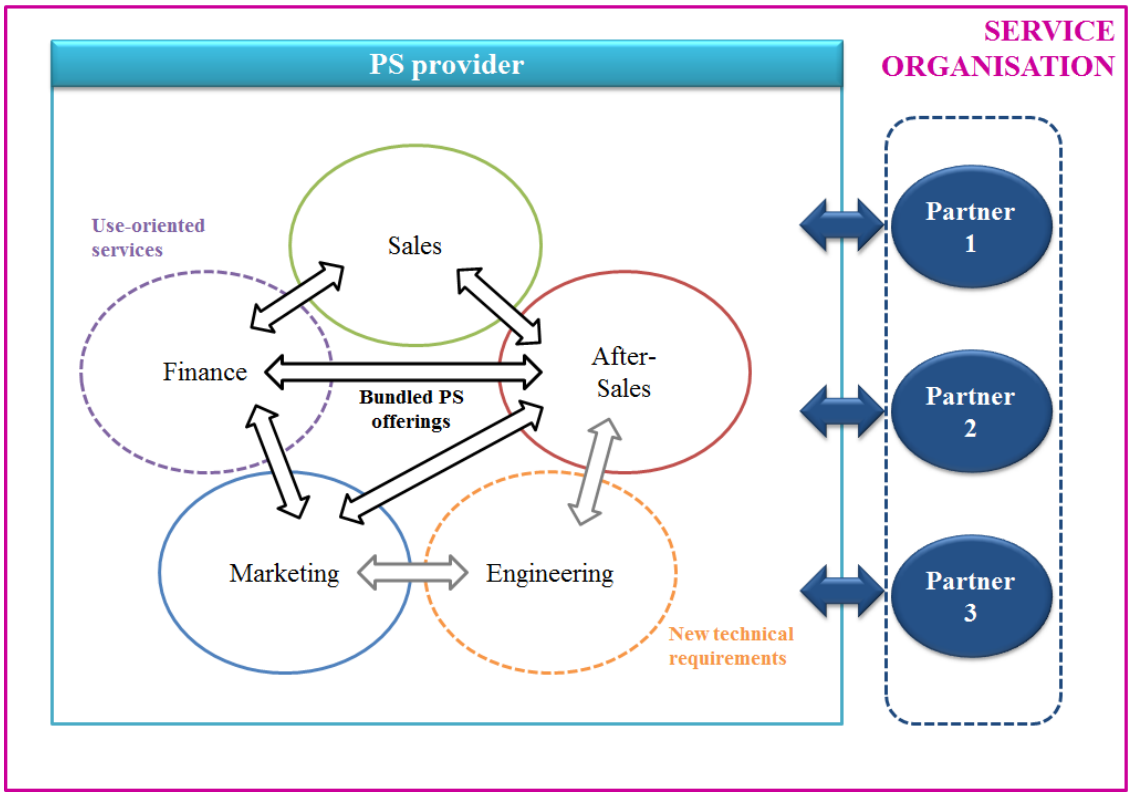


**Figure 62: The evolution of the PS provider and the creation of a Service Organisation**

Consequently, the initial logical statement "*The servitisation level of the Customer Value Proposition is related to: i) the internal integration among functions*" can be detailed by the following four propositions:

**P5**: The internal Service Organisation involves After-Sales, Sales and Marketing functions.

**P6**: The introduction of new services that requires innovative technical product features entails the involvement of the Engineering department in the product design phase.

**P7**: A change of product ownership (from the customer to the PS provider) requires the establishment of an *ad hoc* function.

**P8**: The shift of extent from unbundled to bundled solutions entails a higher coordination between the involved units.

## 6.3 The PS value network's evolution

Service partners are external sources of complementary competences and are part of the service organisation, both for the service and PS provision network (i.e. Martinez et al., 2010; Pawar et al., 2009; Shepherd and Ahmed, 2000; Windhal et al., 2004). As demonstrated by all the case companies, the assistance and sale network is the principal actor in the PS provision network for product-focused services, as external reflection of the internal Sales and After-sales functions. It can be composed by wholly owned or private capital dealers and workshops, or both. There is a high level of vertical control of the PS provider over the network through the requirement of standards enclosed in legal contracts. In addition, strategic objectives are defined centrally by the PS provider and then adapted to the network through the definition of proper KPIs and the related target values. The fulfilment of the assigned objectives is linked to a reward schemes, based essentially on technical aspect of the service provision process and its quality. However, as demonstrated by the Elmoby case study, the assistance and sale network can have a mediator role, and be the main customer-interface, where the customers can turn not only for technical issues related to the product, but also to create the first contact with the partner responsible for installing the charging station at home. Moreover, still considering the Elmoby case study, a product supplier (belonging to the

product network) can also become a PS provision network actor, especially for critical components in case a new technology is in the introduction phase.

With a shift of the offering focus from the product to the customer's activities and processes, the assistance network loses its role as partner of the PS provision network, while the sale network maintain its front role (except for the case of training service provided by Truco and sold directly through the website). However, this aspect is not reflected internally since the After-sale function still plays an important role of coordination and integration. As a matter of fact, new partners (competing in industries different from the automotive sector) are involved in the PS offering management and provision, and they are centrally coordinated by the PS provider After-sale function. The partners act both as service suppliers for the PS provider and as direct service providers for the customers. While for the sale and assistance network the PS provider wields a high vertical control, the service suppliers (that can act also as service providers) are tied to the focal company through partnership relations.

Moreover, the Carco case shows that there can be different tires of partners: the financial company (service partner), in turns, has a partnership with an insurance company to provide the customer with financial and insurance services.

For services that require new technical product features for their provision, there could be the necessity to involve external technical partners, that are in direct relation with the Engineering department.

Finally, the higher is the degree of Service Extent, the higher is number of partners involved (Windahl and Lakemond, 2006) and the higher is the need of coordination mechanisms and tools (ICT tools and shared databases), where the After-sales function plays a central role as system integrator (Davies et al., 2007; Shepherd and Ahmed, 2000).

Figure 63 shows how the value network evolves in accordance with the different dimensions analysed.

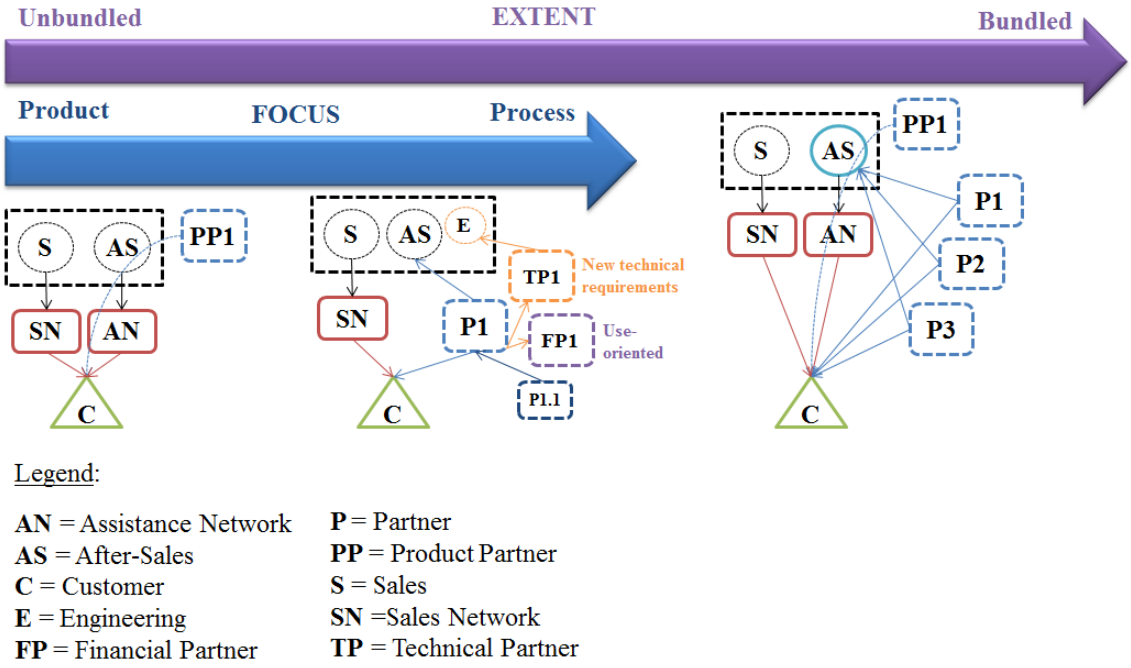


**Figure 63: The evolution of the network**

Consequently, the initial logical statement "*The servitisation level of the Customer Value Proposition is related to: […] ii) the external integration with partners*" can be reformulated as:

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**P9**: The shift of the PS offering focus from product to process entails the establishment of partnership relations with external companies.

**P10a**: The involved partners are managed by the After-sale function of the PS provider.

**P10b**: For services that requires innovative technical product features developed through an external company, the partner is managed by the Engineering department.

**P11**: The After-sale function of the PS provider acts as a system integrator for mixed bundled and bundled offerings.

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## 6.4 The resource's evolution

The evolution of resources is leaded by a change in the PS Offering Focus. Indeed, for product focused offerings (for example Truco's and Tenco's repair and maintenance

services) the resources required for the provision and management are both tangible (such as tools, spare parts, and their supply chain) and intangible (predominantly product knowledge and information). As the focus of the offering changes from product to process, more intangible –basically information and knowledge (Mont, 2002; Vargo and Lusch, 2004) - and human resources (Cook et al., 2006) are needed. This aspect derives from the characteristics of pure services claimed by literature, where the relevance of human capital for services production and management, the critical role of customers and the importance of information (Miles, 1993; Pires et al., 2008; Rubalcaba et al., 2010) are highlight as service distinctive features.

Firstly, the important role played by the human factor in managing and delivery services is associated with substantial investment in human resources and their training (Raja et al., 2010; Gebauer et al., 2010), especially underlined by the Tenco case study. Moreover, the creation of employee commitment to service business may find beneficial to redirect their reward policy accordingly (Antioco et al., 2008). The investigated companies have very structured reward systems for the assistance network, based on technical aspects of the service. Truco and Carco have introduced also bonuses related to customer satisfaction. Other incentives that refer to the service area are given to the sales force in accordance with the number of service contracts sold. At the moment, no company has shown an horizontal reward system that cuts across the functional silos and linked or a compensation based on customer satisfaction (except for the Truco's assistance network), as argued by Sharma (1997), or on corporate/business cluster outcomes (Neu and Brown, 2008) instead.

Secondly, the importance of knowledge and information resources is reflected into the nature of service technologies and ICT (Information and Communication Technologies) tools, that is a recurring theme in all the case studies. Indeed, service technologies are typically described as knowledge technologies, with high capacity for information processing within the technical core (Mills and Moberg, 1982). For example, for telematics and fleet management solutions, the companies' (Truco and Tenco) desire is to better utilise vehicles' technological possibilities and proper information technology applications. Thus, ICT tools (Penttinen and Palmer, 2007) are a critical enabler and supporting elements for *servitization*. In particular, ICT tools enable intra- and inter-firm communication and the creation of databases where companies can save

information (both on product performances and customers' characteristics) and can create a stock of knowledge.

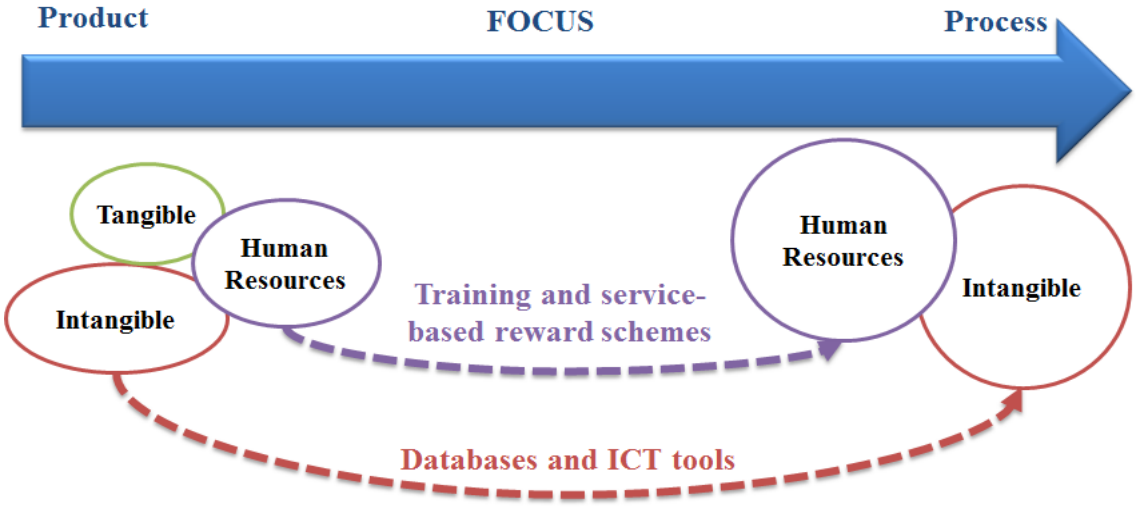


**Figure 64: The evolution of the resources**

Therefore, the initial logical statement "*The servitisation level of the Customer Value Proposition is related to: […] iii) the relevance of human resources*" can be revisited:

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**P12**: The shift from a focus on the product to a focus on the process entails an increasing importance of intangible (information and knowledge) and human resources.

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# 7 Contributions, implications and limitations

Traditional manufacturers have moved into the service realm to maintain their positions in increasingly competitive markets, with a consequent evolution of their business models from a "pure product" orientation towards an integrated Product-Service System (PSS). Despite some successful stories exist, many manufacturing firms have struggled to survive in the service domain. As a matter of fact, tackling a servititization journey involves several challenges for a manufacturing company. It is not enough just to innovate the offering introducing new services and solutions, but further changes in all areas of a company's business model are required, in an organic, structured and coherent fashion. Modifications are needed not only internally, but also externally towards customers, suppliers and partners.

In this context, the overall purpose of this doctoral thesis has been to understand how manufacturing firms can successfully provide Product-Service (PS) offerings to the customers, investigating how the characteristics of such offerings impact on the business model of a PS provider, especially on its resources, competences, organisational features and network relationships. In order to shed light on this aspect, an empirical investigation based on a multiple case study methodology has been conducted and the main findings have been compared to literature, thereby leading to a more comprehensive understanding.

This thesis contribute to the development of the *servitization* field in several ways.

## 7.1 Contribution to literature

As argued by many authors, relevant concepts related to *servitization* are dispersed across a number of different disciplinary literatures, and what are their commonalities, their differences and how they are connected is still not clearly defined. The systematic literature review synthesises the diverse research streams into a coherent picture, creating a common understanding of the salient conceptual and research methodological

dimensions. The main findings are extensively described in paragraph 2.4.2 and are summarised in the following table.

| **How is the servitization phenomenon addressed in literature?** |
|---|
| – The term *servitization* was introduced for the first time in 1988, with an explosion of publications in the last 3 years (37 out of 45);<br>– and represents the *evolutionary phenomenon from a product-centric perspective towards a product-service orientation, based on the provision of integrated bundles consisting of both physical goods and services*.<br>– almost half of the papers refer to Strategy/Management (challenges, strategic trajectories, impact on business models, etc.), followed by Supply Chain Management (impact on the supply chain and the relations with partner and suppliers), Design and Engineering (how to design properly these new solutions), Marketing (relations with customers) and Operations Management (configure internal production and service operations);<br>– mainly from UK and manufacturing sector;<br>– 2/3 empirical research, mostly based on exploratory case studies. |
| **What are the research fields that refer to the *servitization* phenomenon?** |
| – The term PSS appeared for the first time in 2000. Increasing interest in the topic since then;<br>– the main journals are Journal of Cleaner Production (17%), CIRP Journal of Manufacturing Science and Technology (9%), International Journal of Advanced Manufacturing Technology (9%) and Journal of Manufacturing Technology Management (9%), related to the sustainability and the manufacturing field;<br>– the most prolific authors are R. Roy, T. Sakao and O.K. Mont ("mother" of the field, who clarified the concept of PSS and identified its elements);<br>– mainly related to design/engineering (theory building: methodology for PSS design and development) and strategy/management (exploratory: barriers and challenges, general description of new business models, state of the art in specific sectors) disciplines;<br>– even if the general field of PSS grew out of a history of sustainability research, during the last years the attention towards such aspect has dropped;<br>– PSS is a *sustainable business model, characterised by an integrated product-service offering*. |
| – The term Service Dominant Logic (SDL) was used for the first time in 2004 by Vargo and Lusch;<br>– who are also the reference authors for this research stream and who conceptualised the ten foundational premises of SDL;<br>– it represents a *new way to create value, based on service as a fundamental basis of exchange*; |

| |
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| – the publications are strongly related to the USA (34%) and UK (13%);<br>– and to the marketing discipline (76%);<br>– as also shown by the main journals where the papers are published: Journal of the Academy of Marketing Science (11%) , Marketing theory (9%) and Industrial Marketing Management (7%);<br>– methodologically, the field is still under exploration (62%) through conceptual analysis (67%). |
| – Customer/integrated solution are defined as *customised and integrated combinations of product and services offered to provide outcomes and functionalities desired by the customers*;<br>– it is a new field, essentially European (in particular UK, with the 29% of the papers, and Germany with the 15%), related to manufacturing sectors (56%);<br>– and to strategy and management disciplines (52%);<br>– authors come from both business and engineering departments;<br>– the research is still at an early stage, mostly approached through conceptual and empirical case-based methods. |
| **How are these fields connected to the *servitization* research stream?** |
| ***Servitization*** is the evolutionary phenomenon of the business model of a manufacturing company, moving from a product-centric perspective towards **Product-Service Systems (PSSs)**, based on the provision of **integrated bundles consisting of both physical goods and services**, coherently with a **service-dominant logic** of value creation. |

**Table 79: Contribution to literature - summary of the systematic review findings**

The results from the reviews were then used to generate a conceptual model (Figure 65) that aims at describing a Product-Service System as the object of a *servitization* evolution, its constituent elements and the relations between them. For this research, only a part of the model was empirically investigated, showing a much more complicated reality than the theoretical representation provided by the model itself. However, the model can still be used as a basis for future empirical inquiries of the PSS business model aspects neglected by this research.

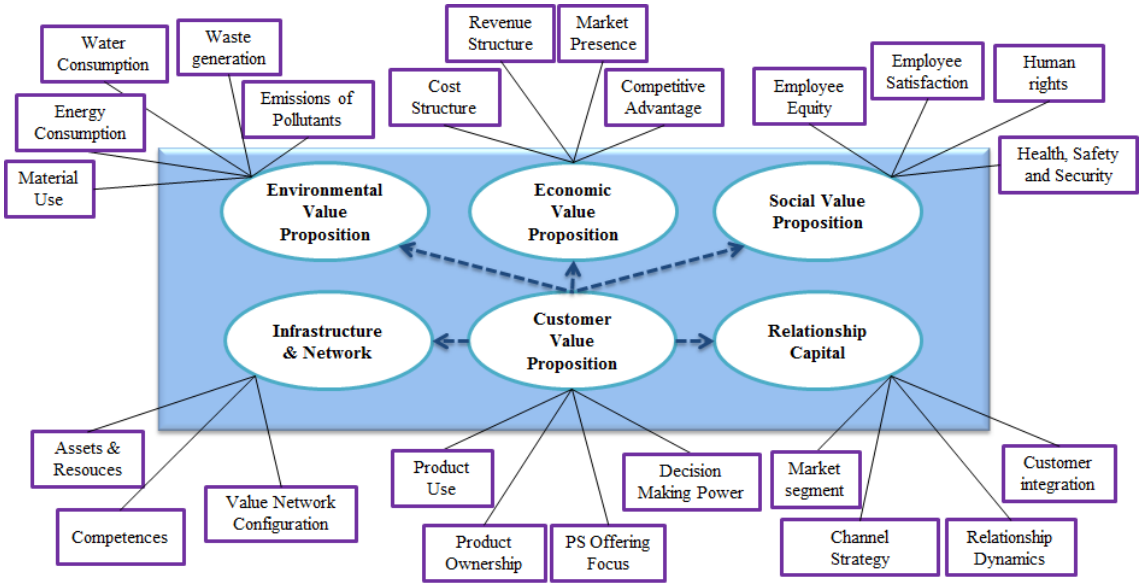


**Figure 65: Contribution to literature – the Sustainable PSS Business Model**

Finally, as results from the case studies analysis, 12 propositions were developed related to how the *servitization* of the PS offering impacts on a PS provider in terms of required competences and resources, organisational characteristics and network relations.

| | |
|---|---|
| **P1 a/b** | Offerings focused on the product are related to traditional technical competences on the product.<br>Offerings focused on the product are delivered directly by the PS provider, generally with the support of its assistance network. |
| **P2 a/b** | The shift of the PS offering focus from product to process requires consultancy capabilities.<br>The shift of the PS offering focus from product to process involves the transformation of salesmen into consultants who are able to understand customer's activities and processes. |
| **P3 a/b** | The shift of the PS offering focus from product to process entails an increasing need of specific competences related to the provided services (service-specific competences).<br>The shift of the PS offering focus from product to process entails the involvement of external partners. |
| **P4** | A change of product ownership (from the customer to the PS provider) requires the development of financial competences. |
| **P5** | The internal Service Organisation involves After-Sales, Sales and Marketing functions. |
| **P6** | The introduction of new services that requires innovative technical product features entails the involvement of the Engineering department in the product design phase. |

| | |
|---|---|
| **P7** | A change of product ownership (from the customer to the PS provider) requires the establishment of an ad hoc function. |
| **P8** | The shift of extent from unbundled to bundled solutions entails a higher coordination between the involved units. |
| **P9** | The shift of the PS offering focus from product to process entails the establishment of partnership relations with external companies. |
| **P10 a/b** | The involved partners are managed by the After-sale function of the PS provider.<br>For services that requires innovative technical product features developed through an external company, the partner is managed by the Engineering department. |
| **P11** | The After-sale function of the PS provider acts as a system integrator for mixed bundled and bundled offerings. |
| **P12** | The shift from a focus on the product to a focus on the process entails an increasing importance of intangible (information and knowledge) and human resources. |

**Table 80: Contribution to literature – Theoretical propositions**

## 7.2 Managerial implications

As already underlined, manufacturers cannot afford to neglect the opportunity presented by services. But creating service businesses, and run them effectively, is far from simple. Companies pursuing this evolution are wrestling with a range of strategic, organisational, and operational issues. With this doctoral thesis, it is offered support to practitioners who are responsible for the actual implementation of PSS solutions.

The first step in tackling a *servitization* journey is to understand what are the services that could be offered to the customers and what are their specific characteristics. As discussed in Chapter 3, there are three main categories of services:

- Product-oriented, where business model is still mainly geared towards sales of products, but some extra services are added;
- Use-oriented, where traditional product still plays a central role, but the business model is not geared towards selling products. The product stays in ownership with the provider, and is made available in a different form;
- Result-oriented, where the client and provider in principle agree on a result, and there is no pre-determined product involved.

The description of the different categories considering the dimensions reported in Figure 66 is a first managerial contribution. This simple classification model can be used to describe the PS offering of a company (actual and/or desire state) and compare it to competitors.

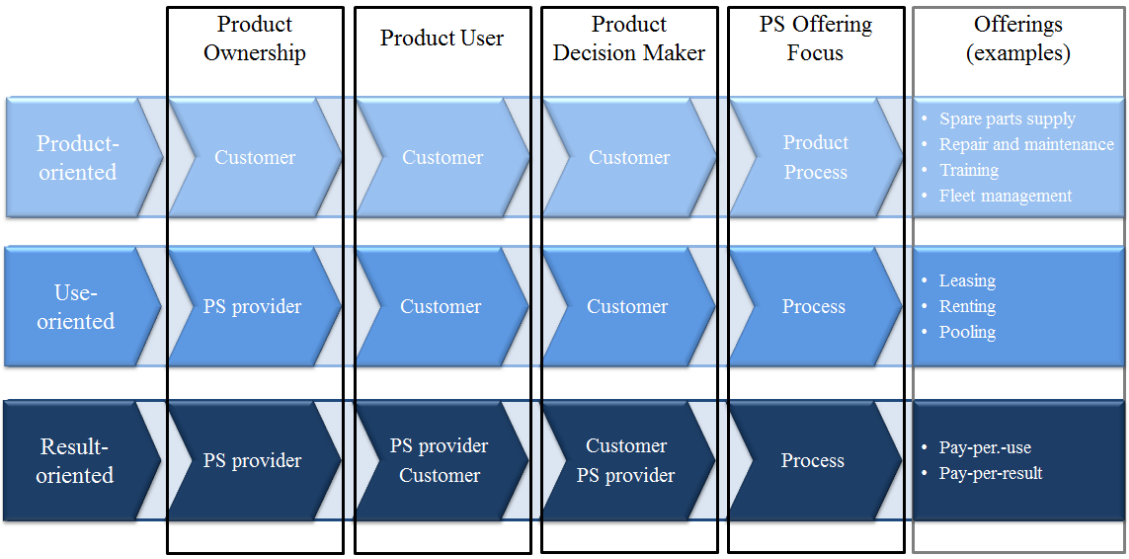


**Figure 66: Managerial contribution - describing a PS offering**

Currently, many companies still focus their business on traditional product-focused services (usually referred to as after-sales) since they usually generate higher profits (especially spare-parts supply). However, other types of services (process-focused), characterised by higher *servitization* level, are gaining importance and managers are recognising their significant potential of growth. Behind these different types of services, there are different type of business models. Introducing a model that represents the architecture of a sustainable PSS Business Model helps managers to easily communicate and share their understanding of a business model (actual and/or potential) and its elements among other stakeholders Thus, it can be used as a foundation for discussion, facilitating change and enabling the reuse of knowledge. As exemplification, in Figure 67 is represented the use of the PSS Sustainable Business Model to describe the Elmoby and its innovative electric mobility offering (the pilot phase of the project).

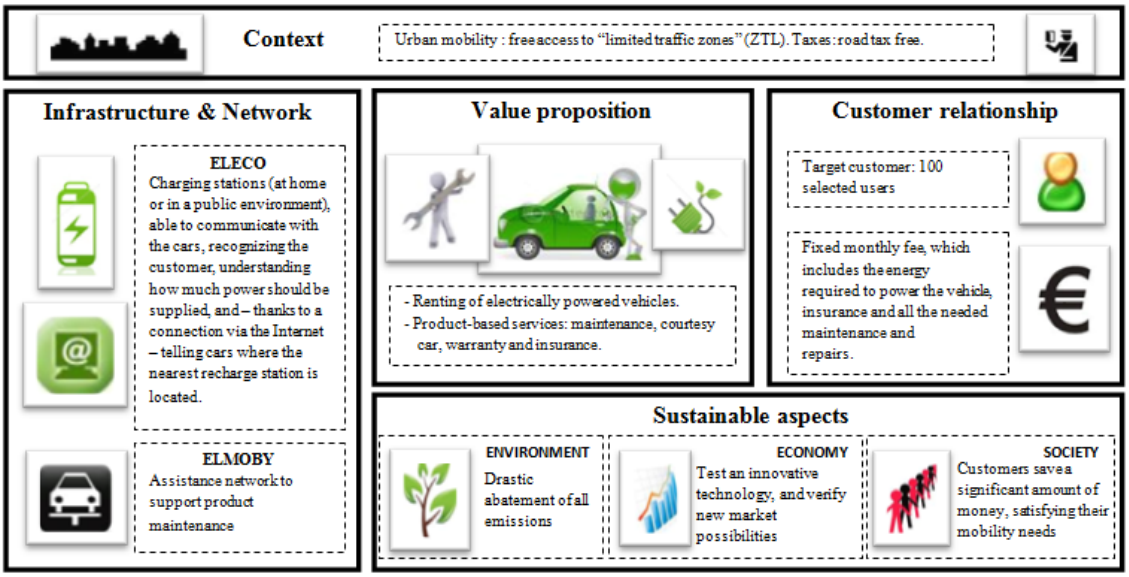


**Figure 67: Managerial contribution - describing a Sustainable PSS Business Model - The Elmoby business model**

Finally, the propositions developed through the empirical investigation help practitioners to understand the challenges in delivering value through a PS solution, moving beyond reasoning about general features of PSSs and focusing the attention of particular aspects, such as competences, resource, organisational structure and network relations. These propositions act as guidelines for the design or re-design of PSS, and in particular to assess the consistency among the product-service value proposition and the infrastructure and network interfaces.

## 7.3 Limitations and suggestions for future research

Some directions for future research can be pointed out to overcome the limitations of this work.

When Result-oriented PSSs provided by OEMs become available in the automotive sector, additional case studies should be conducted in this category, that represents the highest *servitization* level of an offering.

Then, the developed propositions should be tested through statistical methodologies in order to assess their reliability, validity and statistical significance.

Moreover, the empirical enquiry can be replied in different industries to create a base for inter-sector generalizability and to analyse commonalities and differences between diverse sectors.

Another important area of research concerns the impact of *servitization* on the customer-PS provider interface and on the economic, environmental and social value created.

Finally, what are the factors that support (or hinder) the *servitization* of manufacturing companies is an issue that deserves further investigation.

# Appendix: The Case Study Protocol

## Introduction

The purpose of this research is to advance the understanding of Product-Service Systems (PSSs), through the development of a conceptual framework of a sustainable PSS business model, describing the rationale of how a *servitized* organization creates, delivers, and captures value. In particular, the focus of the research is to understand the impact of the *servitization* level of the product-service offering on the organisation and the value creation network of a company.

This protocol describes the field procedures to be followed for each case study.

## Pre-visit preparation

The After Sales director or a person in equivalent position of the chosen company should be sent a letter with a general description of the study and area to be addressed, and soliciting its participation. For participating companies a "project champion" should be identified who will act as the main co-ordinating link between the researcher and the company.

Before the visit begin, archival sources should be investigated to provide background information on the company. These may include company web-site, annual reports, press clippings, company history, databases, and general information about the industry. In particular, the PSS offering of the company should be identified, described, listed and mapped in accordance with the PSS offering taxonomy developed in the research, considering the following dimensions:

- Product Ownership;
- Product Use;
- Decision Making Power;
- PS Offering Focus.

## On-site Data collection

In the initial contact with the company, the researcher need the project champion's help to identify several persons knowledgeable about the areas addressed by the study with whom semi-structured interviews will be conducted. The researcher should also at this stage identify, among the PS value propositions (or PS offerings) identified during the pre-visit preparation phase, the one(s) on which some of the subsequent data collection efforts will focus.

The researcher should also interview the project champion on the questionnaire included in Annex 1. It requests general company's information, as well as information specific to the PS value proposition.

The researcher should collect information in three major areas:

A. Value proposition and its evolution over time;
B. Company's network of partners;
C. Company's internal organisation and configuration;

The next section specify in detail how the data should be collected.

## Value proposition and its evolution over time

The following table shows the Value proposition areas to be addressed, the questions that the researcher must keep in mind and that must be answered about each area, the unit of measurement to which the question should refer to, and the field procedures and the potential sources of information for answering those questions. The questions marked with "Q" are also addressed directly in the questionnaire.

| Value proposition area | Unit of measurement | Questions | Field procedures/Source of Information |
|---|---|---|---|
| Identification of the PS value proposition offered to the national market | Company | − Verification of the Value propositions previously identified by the researcher (Q) | − Interviews: discuss answer given in the questionnaire<br>− Documentation (Service brochures)<br>− Web site<br>− Questionnaire |
| PS value | Company | − Verification of the | − Interviews |

| | | | |
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| proposition mapping and categorisation | | offering map previously developed by the researcher | |
| Business Environment | Company | – Key trends of the business environment | – Interviews<br>– Archival Sources (background information on the industry) |

**Company's network of partners**

The following table shows the two main categories of partners to be analysed for each PSS offering category identified in Section 3.1, the questions that the researcher must keep in mind and that must be answered about each partner and each PSS offering category, the unit of measurement to which the questions should refer to, and the field procedures and potential sources of information for answering those questions.

| Network of partner area | Unit of measurement | Questions | Field procedures/Source of Information |
|---|---|---|---|
| Assistance service network | PSS offering | – How large is the assistance service network?<br>– How is it structured?<br>– Which is the property level of the assistance service network?<br>– Which is the geographical coverage?<br>– Which is the control level of the company on the assistance network in terms of information sharing (quantity, quality and type of exchanged information)<br>– Who is the internal reference the network deals with? | – Interviews |
| Partner | PSS offering | – Who are the key partners?<br>– What kind of relations | – Interviews |

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| | | exist with them(strategic alliance between non-competitors, cooperation, joint ventures, buyer-supplier relationship)?<br>- Which key resources does the company acquire from partners?<br>- Who is the internal reference the partners deals with? | |

**Company's internal configuration and organisation**

The following table shows the organizational structure, resources, capabilities and competences of a company, the questions that the researcher must keep in mind and that must be answered for each PS offering, the unit of measurement to which the questions should refer to, and the field procedures and potential sources of information for answering those questions.

| PS provider area | Unit of measurement | Questions | Field procedures/Source of Information |
|---|---|---|---|
| Organisational structure | PS offering | - How is the PS offering managed (dedicated function, business unit, …)?<br>- What are the responsibilities of the function(s) in charge of managing the PS offering (cost centre vs. profits and losses)<br>- How does the function/business unit collaborate with other functions/business units?<br>- How does the function/business unit communicate with other functions/business | - Interviews |

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| | | units?<br>- How frequent are cross-functional communications? | |
| Resources | PS offering | - What are the tangible assets required (current vs. fixed)?<br>- What are the intangible assets required (goodwill, copyrights, trademarks, patents and computer programs)?<br>- What are the information assets required (type of data and ICT tools)? | - Interviews |
| Competences | PS offering | - What are skills required?<br>- What are the training course provided to employees?<br>- How are structured the personnel assessment and compensation?<br>- What are the key resources (physical, intellectual, human, financial)? | - Interviews |

**Post-visit stage**

A report should be produced as soon after the visit as possible. It should contain all the notes and documents categorised by research variable and organised into a coherent text within each category. It should also include any reflections by the researcher about case-study questions attempting to integrate the available evidence and to converge upon the facts of the matter or their tentative interpretation.