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***TOWARDS A NEW CONCEPTION OF VALUE CREATION:
SERVITIZATION AND DIGITALIZATION IN PROJECT BASED
FIRMS***

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TESIS DOCTORAL / DOCTORAL THESIS

***TOWARDS A NEW CONCEPTION OF VALUE CREATION:
SERVITIZATION AND DIGITALIZATION IN PROJECT BASED
FIRMS***

MENCIÓN DE DOCTORADO INTERNACIONAL

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A mis Padres,
por el incondicional amor a sus hijos

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

1.1	Background to the research	1
1.2	Interest of the research	2
1.3	Justification of the research	2
1.4	Objectives of the Thesis.....	3
1.5	Structure of the research work.....	4
1.6	Conclusions	5

PART I: THEORETICAL FRAMEWORK & CONTEXTUALIZATION

CHAPTER II: CONCEPTUALIZATION OF VALUE CREATION

2.1	Introduction.....	11
2.2	The traditional conception of the process of value creation	12
2.2.1	Good-Dominant logic.....	13
2.2.2	The value chain from a Good-Dominant logic perspective	14
2.2.3	Critique / Limitations of the Good-Dominant logic	15
2.3	The nature of value: “value in exchange” Vs “value in use”	15
2.4	Value creation in Project Business	18

CHAPTER III: TOWARDS NEW STRATEGIES BASED ON S-D LOGIC AND VALUE “IN USE”

3.1	Introduction	23
3.2	A new conception of value creation	23
3.2.1	Service-Dominant logic.....	24
3.2.2	Customer in the focus of value creation	26
3.2.3	Customers – Firms interactions.....	27
3.2.4	The value chain from a Good-Dominant logic perspective	29
3.3	New strategies of value creation	30
3.3.1	Co-creation.....	30
3.3.1.1	Discussion of Co-creation.....	32
3.3.2	Customerization	33
3.4	Implications of the new conception in value creation	34
3.4.1	The identification process.....	35

CHAPTER IV: SERVITIZATION

4.1	Introduction	39
4.2	Definition & Importance	39
4.3	Value Creation in Servitization	40
4.3.1	Types of Services.....	40
4.3.2	Advanced Services	41
4.4	Transformations that Servitization implies	42
4.4.1	Organizational implications.....	43
4.4.2	Factors enabling the adoption of servitization strategies	43
4.4.3	Facilitators and inhibitors in Servitization.....	44
4.4.3.1	Inhibitors for clients	44
4.4.3.2	Facilitators for clients.....	45
4.4.3.3	Inhibitors for services suppliers	45
4.4.3.4	Facilitators for services suppliers	46

4.4.4	Benefits derived from Servitization	46
4.4.4.1	Benefits for Clients	47
4.4.4.2	Benefits for services suppliers.....	47
4.5	Difficulties in implementing servitization	48
4.6	Potential of Servitization in Global Economy.....	49

CHAPTER V: BUSINESS DIGITALIZATION

5.1	Introduction.....	53
5.2	Communication technologies as tool for value creation	54
5.3	Service-oriented technologies.....	55
5.3.1	Monitoring technologies.....	56
5.3.2	Internet of things.....	56
5.3.3	Cloud computing	58
5.3.4	Pervasive computing	60
5.3.4.1	Radio-frequency identification (RFID)	60
5.3.4.2	Wireless sensor network (WSN)	61
5.3.4.3	Wireless body area network (WBAN)	61
5.3.5	Big data	61
5.4	Visualization tools	64
5.5	The potential of digitization in value creation	64
5.5.1	Main fields of application	66
5.6	Barriers in value creation from digitization	67

PART II: SERVITIZATION AND DIGITALIZATION IN PROJECT BUSINESS

CHAPTER VI: TOWARDS NEW MODELS OF VALUE CREATION IN PROJECT BUSINESS

6.1	Introduction.....	73
6.2	The new perspective of value creation in Project Business	73
6.3	How servitization can transform business models in PBFs	75
6.4	The role of new technologies in Project Business	75
6.4.1	Monitoring architectures in project management.....	76
6.5	Network perspective for creating value in PBFs.....	78

CHAPTER VII: SERVICE-ORIENTED BUSINESS MODELS IN PROJECT BASED FIRMS: THE CASE OF ENERGY EFFICIENT ARCHITECTURE

7.1	Introduction.....	81
7.2	Literature Review	84
7.2.1	A theoretical Review of Servitization	84
7.2.2	Business Models	85
7.2.3	Project Based Firms	86
7.2.4	Energy efficient architecture	87
7.3	Framework development.....	90
7.4	Methodology	97
7.5	Findings and Discussion	98
7.6	Conclusions	102

CHAPTER VIII: SERVICIZATION AND DIGITALIZATION IN ENGINEERING COMPANIES

8.1	Introduction.....	107
8.2	Literature Review.....	109
8.2.1	Servitization & Engineering Companies	109
8.2.2	Digitization in Engineering Companies.....	111
8.3	Enablers for servitization strategy in Engineering companies....	113
8.4	Servitization and smart services in civil engineering companies: a business model development.....	116
8.5	Getting information. The importance of data management	123
8.6	Implications and Conclusions	125

PART III: CONCLUSIONS & IMPLICATIONS

CAPÍTULO XIX: FINAL CONCLUSIONS AND IMPLICATIONS

9.1	Introduction	131
9.2	General Conclusions	131
9.3	Research implications	143
9.3.1	Theoretical implications.....	143
9.3.2	Managerial implications.....	145
9.4	Limitations	148
9.5	Future research lines	149

CAPÍTULO X: CONCLUSIONES FINALES E IMPLICACIONES

10.1	Introducción	153
10.2	Conclusiones del Trabajo de Investigación	153
10.3	Implicaciones del Trabajo de Investigación	167
10.3.1	Implicaciones Teóricas.....	167
10.3.2	Implicaciones Prácticas.....	169
10.4	Limitaciones del Estudio	172
10.5	Futuras líneas de investigación propuestas	174

ANNEXES	177
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COMPLETE BLIBLIOGRAPHY	183
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LIST OF TABLES

TABLE 3.1 <i>The transformation of the relationship between firms and customers as a consequence of the new conception of value creation</i>	26
TABLE 3.2 <i>Factors that defines what Co-creation is</i>	31
TABLE 7.1 <i>The impact of services on business models for PBFs</i>	96
TABLE 8.1 <i>Enablers for servitization strategy in Engineering companies</i>	113

LIST OF FIGURES

FIGURA 2.1 <i>Firm-Customer interactions and Market from the traditional perspective of value creation</i>	14
FIGURA 2.2 <i>G-D logic vs S-D logic in Value Creation</i>	17
FIGURA 3.1 <i>Firm-Customer interactions and Market from the new perspective of Value Creation</i>	25
FIGURA 3.2 <i>Main elements in Customer – Firms interactions”</i>	28
FIGURA 4.1 <i>Taxonomy of Services</i>	41
FIGURA 5.1 <i>The new dimension of connectivity: connectivity of anything</i>	57
FIGURA 5.2 <i>Categorization of Data</i>	62
FIGURA 5.3 <i>Categorization of Analytics</i>	63
FIGURA 5.4 <i>The 5 Vs of Big Data</i>	63
FIGURA 7.1 <i>Framework for servitized business models in Project Based Firms</i>	91
FIGURA 8.1 <i>Factors encouraging Servitization strategies in PBFs</i>	109
FIGURA 8.2 <i>Evolution towards Servitization Strategy in Engineering companies</i>	110
FIGURA 8.3 <i>Servitization strategy in Engineering companies based on smart technologies</i>	117
FIGURA 8.4 <i>Diagram of monitoring architecture</i>	122
FIGURA 8.5 <i>The process to offer Services based on Structural health Monitoring</i>	124

CHAPTER I
INTRODUCTION

1.1 BACKGROUND TO THE RESEARCH

Value creation is a fundamental concept in business strategy and for the definition of business models. The conceptualization of value, of its creation and perception has been widely debated throughout history. Traditionally, value creation has been regarded as an internal process of companies. However, in recent years a new conceptualization is being developed. This notion of value places customers and their experiences during the "consumption or use" of a product or service in the focus of value creation. This paradigm shift is allowing the development of new strategies and business models.

On the other hand, the technological blossoming we are witnessing in the development of connectivity, sensing, data storage and data analysis put firms at a decisive moment to take a step forward in the knowledge of the consumption patterns and behavior of real customers (Grubic, 2014). It represents an unprecedented advance in determining the value of products and services that companies put on the market.

This is the reason why companies are currently at a time in which they should "rethink" their view of value creation, adapting their business models to new technologies and new modes of competing and create value.

This study will focus on the application of this conception of value for companies that base their activities on projects (PBFs), as well as on Project Management itself (PM). In this fields has been defined the need to reorient their research paradigms in order to understand better the generation of value in projects, and its links with technology, learning and the development of new competences (Winter, Smith, Morris, & Cicmil, 2006).

1.2 INTEREST OF THE RESEARCH

Within the strategic management of value chain (Porter & Millar, 1985), understanding the paradigm shift in value creation and the study of new strategies based on it are key elements to the progress of research in this field. Following this line, it is particularly important the analysis of new business models configurations based on the introduction of services and to increase the knowledge in the exploitation of information flows generated through these services.

On the other hand, there is growing interest on the processes of adoption of these new strategies of value creation in different productive sectors (Chacon & Aranda, 2014; Laursen & Svejvig, 2015). In particular, the introduction of Servitization strategy in project-based firms and the development of servitized business models in this sector are aspects which need further research (Wikström, Hellström, Artto, Kujala, & Kujala, 2009) and the present work tries to shed light on it.

1.3 JUSTIFICATION OF THE RESEARCH

This study goes into the new conceptualization of value creation and focuses on the need to generate knowledge in the development of Servitization strategies (Baines et al., 2016a; Vandermerwe & Rada, 1989), as well as on the need to adapt and extend this strategy to other sectors apart from manufacturing.

Another motivation behind this research is the need for companies to set up their business model so that they are able to exploit the potential of existing and new technologies to extract a value from processes, services and products in a way that until now was impossible to obtain.

In general, this thesis seeks to put a focus on new value creation strategies. With particular emphasis on those strategies related to the inclusion

of advanced services that rely on the use of new technologies (Vendrell-Herrero, Bustinza, Parry, & Georgantzis, 2016)

The main justification of the study is to try to generate knowledge that will be of use for the management and implementation of this strategic change and to present their application in the field of Project based firms.

1.4 OBJECTIVES OF THE THESIS

In this section, a number of objectives to be achieved throughout the research are defined:

- Understand the conceptualization of value; its creation and perception. Starting from the most traditional definitions of value and studying its evolution towards a new conceptualization.
- Define and shed light on how the new concept of value and the new Service-Dominant logic act as a theoretical framework for the development of new strategies in value creation.
- Explain Servitization process as transformative strategy for business model: the implications of its implementation, the barriers to its adoption, benefits and impacts at company level and at the macro-economic level.
- Define and study the phenomenon of business digitalization and to present taxonomy of new technologies which have influence in new value creation. Understand Digitization is a key enabler of services based strategies
- Finally, generate new knowledge about the implementation of these new strategies of value creation in the sector of the PBFs and Project Management

1.5 ESTRUCTURE OF THE RESEARCH WORK

The structure of this thesis seeks to facilitate a holistic understanding of the processes that have led to defining a new dominant logic of value creation and how this new conception of value drives the development of innovative strategies and changes in business models.

This thesis adopts a time-line in trying to explain changes in the value creation and the development of new strategies based on services and value "in use", from its genesis to its practical application. To that end, we distinguish three main blocs within this study: a first part of contextualization and theoretical development including Chapters 2 through 5, a second part more focused on direct application of the concepts and theories presented in the first bloc, and finally a third part in which the overall conclusions and implications derived from this thesis as a whole will be presented.

In a summarized way, we will take a tour along each Chapter of the thesis:

In Chapter 2, we focus on making a conceptualization of value, trying to examine their evolution from classic to the most current theories.

In Chapter 3, the aim is to delve into the conceptualization of value "in use" and analyze some of the concepts and strategies linked to the S-D logic: co-creation and customerization. At the end of the Chapter, implications derived from adoption of these new strategies are studied.

Chapter 4 deals with Servitization strategy, focusing on its definition, importance and factors enabling or hindering its adoption. We will also study the benefits and impacts for both service suppliers and customers.

Chapter 5 focuses on the process of digitization in companies. This process is presented as the great enabler for the adoption of new strategies of value “in use”. This section will present and discuss the technological tools necessary to perform this process in a business as well as its benefits, barriers and implications.

In the part two of the study, Chapter 6 studies the evolution of value creation in the field of Project Based firms, justifying the introduction of new strategies such as Servitization and the use of new technological tools to develop innovation in value creation.

In Chapter 7 a case study on Servitization strategy for Energy-Efficient Architecture is presented. Through this particular research, an analysis about the impacts of the inclusion of services in business models within PBFs sector is performed.

Chapter 8 examines Servitization and digitization phenomena in the engineering sector, defining a model that provides valuable information on the implementation of these strategies. The study also proposes new technological services to be introduced in project business and competitive advantages that can be achieved.

Chapter 9 summarizes final conclusions of this thesis and establishes both theoretical and practical implications from the research developed.

1.6 CONCLUSIONS

The present research will try to delve into new strategies of value creation in which value is co-created together with the customer (Vargo & Lusch, 2004). To achieve this objective we will focus on different strategies that involve the inclusion of services, the obtaining of information about customers and their consumption habits and the inclusion of new technologies to generate value.

In particular we try to obtain new knowledge about implementing these new strategies, with a special focus on project-based business sector and project management.

The leitmotiv of this research is to provide an overview allowing a proper understanding of the evolution of value creation and how the new conception involves the development of new strategies that focus on customer interactions and on an improved knowledge of his behavior. Finally, particularities of the new creation of value in the sector PBFs are studied, proposing business models adapted to this new understanding of the value; mainly characterized by the inclusion of services and the application of new technologies to create value.

PART I

**THEORETICAL FRAMEWORK &
CONTEXTUALIZATION**

CHAPTER II

CONCEPTUALIZATION OF VALUE CREATION

2.1 INTRODUCTION

The notion of value has been historically discussed and debated. From Plato or Aristotle (Fleetwood, 1997) passing through Medieval Schoolmen (Dixon, 1990; Vargo, Maglio, & Akaka, 2008) and (Smith, 1776), to the present time. The conceptualization of value has been present in the core development of economic and marketing theories (Vargo et al., 2008) and has been approached from very different theoretical perspectives: philosophy, economics, marketing and management.

From the classical perspective applicable in our field, the meaning of value can be understood as “goodness” in the description of a product or an activity which is physically external to the subject (Ng & Smith, 2012). Particularly, in an overall view, we can distinguish two general trends of thought regarding the concept of value: “value-in-exchange” and “value-in-use”, which reflect two different ways of thinking about value creation and value perception.

Through this chapter, we are going to study the implications that the different conceptions of value have in the development of theories and business strategies. We also show how the role of firm and consumer in value creation changes depending on the conceptualization of value. The chapter has been structured as follows: we begin studying the more classical and commonly accepted perception of value, which until now most theories have sustained. Right afterwards, we contrast the two mainstream of thought in value creation: “value-in-exchange” and “value-in-use”. In the final part of the chapter we will review the creation of value from the perspective of Project Business.

2.2 THE TRADITIONAL CONCEPTION OF THE PROCESS OF VALUE CREATION

The classical view of Economy has conceived the value as value-in-exchange. For this reason, this is the conceptualization of value which has been primarily applied in the field of Management (Beckman, 1957; Drucker; Woodruff, 1997).

Based on the conceptualization of "sales value" of products (Beckman, 1957), were developed and evolved the conventional theories of Marketing (Cox, Goodman, & Fichandler, 1965) and more relevant in our case, some of the most established Management theories: in particular, those that considering value as utility (Anand, 1995; Fishburn, 1970; Kreps, 1988; Nash Jr, 1950; Von Neumann & Morgenstern, 2007) and also those which conceptualize value as economic worth of the consumer for the company (Haenlein, Kaplan, & Schoder, 2006; Hooper, Steeple, & Winters, 2001; Venkatesan & Kumar, 2004). These approaches are mainly firm-centric and hold that value is "created" through different activities which are carried out for the firm. The value is determined by the firm and the role of the customer is viewed in terms of monetary worth for the firms.

In sum, and from a managerial perspective, the traditional concept of value creation considers that value is created inside the firm through its different internal activities and his interactions with other companies within the value chain (Porter, 1980). And even more important, this literature stream considers value as something inherent to the product or service. As a consequence, the customer is perceived as a passive actor who acts just as an appraiser instead of being an active participant in the process of value creation.

This perspective also theorizes that the market is focused on the firm and consumers are outside of generation of value (McKee, Varadarajan, & Pride, 1989; Moran & Ghoshal, 1996). By following this stream, firms conceptualize their relationships with customers just as an appropriate guidance and management of its "theoretical" customers (Prahalad & Ramaswamy, 2004).

2.2.1 Good-dominant Logic

The concept of dominant Logic can be defined as a mental representation which is shared by a majority of managers. Based on their experiences, managers determine which is the logic that should follow a business and what are the expected changes in the behavior of a business (Kiesler & Sproull, 1982). It is a joint perception of how to run a business and what will be the most useful tools and approaches according to this operational logic. The dominant logic has a big influence when managers decide to make decisions about your business (Prahalad & Bettis, 1986).

The traditional doming logic in value creation is known as Good Dominant Logic and is closely related with the traditional view of value (value “in exchange”) (Vargo & Lusch, 2004). According to this dominant logic, the value is created by the firm through its operations and subsequently distributed in the market. The customer perceives the value in the exchange between goods and money (Vargo et al., 2008)

Therefore, value is revealed in exchange for both firms and customers and is in the market where the exchange of value takes placed (Prahalad & Ramaswamy, 2004). Following this trend, the interactions between customers and firms (Figure 2.1) are not observed as potential sources of value creation (Normann & Ramirez, 1994; Wikström, 1996).

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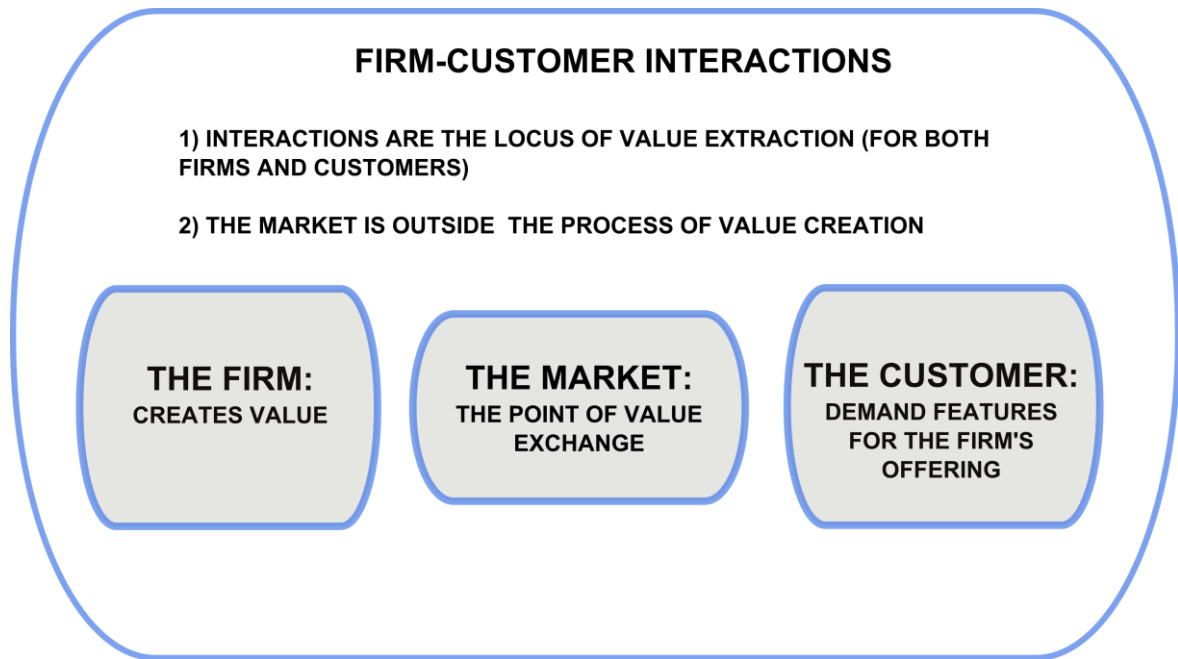


Figure 2.1: “Firm-Customer interactions and Market from the traditional perspective of value creation”. Adapted from: (Prahalad & Ramaswamy, 2004)

2.2.2 The value chain from a good-dominant logic perspective

As we observed, Good-Dominant Logic holds the idea that value is created inside the firms. This unilateral role of the company in value creation is also revealed in the concept of “value chain” (Porter, 1980).

(Porter & Millar, 1985) conceptualize the value chain through the activities carried out by the company and the economic implications thereof. Thereby, different activities and organizational configurations are studied and proposed as more suitable for increasing value creation (Amit & Zott, 2001).

In this context, value is defined as the amount that customers are willing to pay for what they acquire. So, profitability of the company is positive if this amount is higher than the costs involved in creating that good. Therefore, margins to increase value creation are at different stages of the value chain. It means that sources of value creation (Porter & Millar, 1985) only can be found

in the different modes of conduct primary activities inherent to the company (operations, logistic, marketing, organization).

2.2.3 Critique / Limitations of Good Dominant Logic

From the perspective of the G-D Logic, the customer is excluded from the process of value creation. This logic also argues that the creation of value ends when the product is "consumed" or "acquired" (at the beginning of its lifespan or life-cycle). That is, the value creation process culminates with the sale of a good (product or service). Perceived value is determined by the amount that customer has been willing to pay, and at that point the process ends. There is no value in "use" (Grönroos, 2008; Normann, 2001).

Moreover, this vision of value creation underestimates the context and contingencies of customers in the consumption act. Therefore, this logic does not take into account changes in the context or in customer resources that could lead to a different perception of value that is offered from the firm, and that could lead to an abandonment of customer loyalty to a product or a service (Ng & Smith, 2012).

2.3 THE NATURE OF VALUE: "VALUE IN EXCHANGE" VS "VALUE IN USE"

As we mentioned in the introduction of this chapter, the conceptualization of value has been historically discussed from very different perspectives and has evolved throughout history. From an overall point of view, we can distinguish two main conceptualizations of value, which in turn, reflect two different ways of interpreting the creation of value: value "in exchange" and value "in use".

These two conceptions of value are present from the outset of economic exchange, which arises from the assumption that what initially demonstrated

value in use, acquired as a result value for exchange. This supposition drifts towards the concept of "Commodification" (Marx & Engels, 1867).

On the other hand, by following this line, the "value" of an object itself, depends on its properties and the context of its customers. The consideration that a product is intrinsically "valuable" would result from the repetition of customers who perceive it as "good" or "valuable" in similar contexts. However, under this assumption, the individual consumption experience and the heterogeneity of the contexts in which it happens are undervalued (Ballantyne & Varey, 2006; Gentile, Spiller, & Noci, 2007).

One of the main reasons of this undervaluation is that the perceived value in "use" primarily occurs in the private sphere of the customer, and after the purchase event. It involves a high difficulty in obtaining this information, because of the low visibility of these data and the complex understanding of the "use" of something and the contexts around this "use" (Parry, Brax, Maull, & Ng, 2015). As a result of these difficulties and the presence of dominant logic based on value "in exchange" in which the relationship with the customer is limited to the sale event, the interest of the companies for the information surrounding the consumption experience has been very low till recent times.

In sum, till now we have observed how the traditional view of value, closely related to the G-D logic, conceptualizes value creation as value "in exchange", distinguishes the roles of "producers" and "customers" and attributes the creation of value to the firm, which is responsible for providing value to their products or services through their value chain. Firms are also responsible for distributing this value in the market (Vargo & Lusch, 2004; Vargo & Morgan, 2005). The role of the customer is limited to "use or consume" the value embedded in those products or services.

In contrast to this more traditional view of value creation a new and alternative dominant logic arises. Service-Dominant Logic conceptualizes a new perspective on value creation according to which, the value is revealed in the "use" and "experience" that the costumer makes of a product or service

(Vargo et al., 2008). According to this perspective, there is no value until a product or a service is "used", because the value that customer perceive during this "use" is critical to determining the actual value of the "value proposition" launched by the firm to the market (Lusch & Vargo, 2006).

The following figure (Figure 2.2) shows the comparison between the two dominant logics in value creation: Good-Dominant Logic and Service-Dominant Logic.

	Good-Dominant Logic	Service-Dominant Logic
Value Driver	Value-in-exchange	Value-in-use or Value-in-context
Creator of Value	Firm	Firm, network partners and Customers
Process of value creation	Firms embed value in "goods" or "services, value is added by enhancing or increasign attributes	Firm propose value through market offerings. Customers continue value-creation through use
Purpose of value	Increase the wealth of the Firm	Increase adaptaility, survivability, and system wellbeing through applied knowledge and skills of others
Measurement of value	The amount of nominal value, price received in exchange	The adaptability and survivability of the beneficiary system
Resources used	Primarily, operand resources	Primarily operant resources, sometimes transferred by embedding them in operand resources-goods
Role of Firm	Produce and distribute value	Propose and co-create value, provide services
Role of Goods	Units of output, operand resources that are embedded with value	Vehicle for operant resources, enables access to benefit of firm competences
Role of Customers	To use or destroy value created by the firm	Co-create value through the integration of firm-provided resources with other private and public resources

Fig.2.2: "G-D logic VS S-D logic in Value Creation". Adapted from (Vargo et al., 2008)

According to the S-D logic the value is co-created between companies and customers and this co-creation takes place during the interactions between them. This process is enabled by the integration of firm resources which are made available to the customer for value creation (Vargo et al., 2008).

Therefore, we can conclude that one of the main characteristics of S-D logic is to consider the customer as a co-creator of value. This fact leads to a focus on the development of dialogue (firm-customer) and increases the importance of interactions as a method of improving customer-company relationships (Payne, Storbacka, & Frow, 2008)

In the next chapter we will study the Service-Dominant Logic and the concept of value “in use” more deeply. And we understand better the link between this conception of value and the business strategies which constitute the main subject of this thesis.

2.4 VALUE CREATION IN PROJECT BUSINESS

Value creation in Project Based Firms (PBFs) and Project Management presents particular characteristics (Cicmil, Williams, Thomas, & Hodgson, 2006). This requires a particularized study that allows us to understand the evolution of value creation in this field and to contextualize the strategic proposals that will be developed in the second part of this thesis.

The interest in value creation within project management began in the 1940s with the aim of optimizing projects and the processes that take place in it. Later, the term “value management” was introduced. This concept derived from industrial engineering sought to provide a more general view of value (Green, 1994; Thiry, 2002). However, value management has been more focused on minimizing costs than on seeking a more comprehensive improvement of the value creation in projects (Morris, 2013).

Traditionally, the value creation in PBFs and Project Management has been focused on delivering project outputs, considering primarily these outputs

as products (Laursen & Svejvig, 2015). Under this perspective of value creation the focus has been on providing delivery in appropriate terms of time, quality and budget, which is known in Project Management as the "iron triangle". During the last decades this conception has been followed to define the success and the value of a project (Andersen, 2008; Atkinson, 1999). This view of value generation value approximates the notion of value in this area to the traditional notion of value "in exchange".

However, this perspective of value creation in projects can be observed as controversial because the delivery of a project, even in terms of quality, time and budget does not guarantee the creation of value for the firm (Winter & Szczepanek, 2008). Thus, a change of perspective on value creation is being observed lately. The focus solely on the product (Project delivery) is giving way to a focus both the product (Project deliver) and other adjacent activities oriented to value creation in the project (Winter et al., 2006; Zwikael & Smyrk, 2012).

Another peculiarity of the concept of value in PBFs is the difficulty to define the value within a project, since the perception of value may vary widely depending on the perspective of the different stakeholders: companies, customers or users (Lepak, Smith, & Taylor, 2007). Another factor which had been marginalized in the tradition view of value creation and right now is just beginning to be noticed in Project Management is the fact that the value is mainly perceived by the customer or user during the lifetime of the project. Traditionally, the customer perception of value in projects was closely related with the concepts of project start and end of the project (Winter & Szczepanek, 2008). This revelation is the starting point to link value creation in the PBF and Project management with the notion of value "in use", because are the users, while using what is delivered as a result of the project, who primarily determine the value of it.

As a result of the above, some of the most complete reviews on Project Business conducted in recent years (e.g. (Winter et al., 2006; Winter & Szczepanek, 2008) consider the creation of value in this field as one of the main

directions that need further research. The objective sought is to update the value generation in projects and provide PBFs and project managers with better tools to deal with the increasing complexity of projects, understanding new ways to create value and make it perceivable (Winter et al., 2006)

CHAPTER III

**TOWARDS NEW STRATEGIES BASED ON S-D LOGIC AND
VALUE "IN USE"**

3.1 INTRODUCTION

As we have been analyzing in second chapter of this thesis, a new perspective of value creation is increasingly spreading. This value conception entails the proposition of innovative strategies based on this new notion of value "in use", services and consumption experiences.

This focus on new conception of value creation is having strong implications in Management, Marketing and Operation and it is also affecting different sectors in Economy (Vendrell-Herrero & Wilson, 2016).

3.2 THE NEW CONCEPTION OF VALUE CREATION

Following on from the conceptualization of value "in use", recent literature begins to consider value creation as a process that should be focused on the customer and on the "use" they make of a product or service, that is, the phenomenological experience of the customer (Holbrook, 1999, 2006). The customer changes from being viewed a passive subject in the value creation to be seen as an active element in that process (Vargo & Lusch, 2004).

This new perspective holds that firm abandons her exclusive role of value creator to adopt a new role in which makes value propositions to their customers, that is, offerings of potential value to be determined by the client through the use or consumption of goods or services (Ng, Nudurupati, & Tasker, 2010). In essence, customer and firm become active participants in creating value by integrating their resources (Chandler & Vargo, 2011).

As a consequence, value creation stop being observed as a linear process to being understood as the result of a dynamic system of relations between firm and customer (Vargo & Lusch, 2011).

3.2.1 Service-Dominant Logic

In the first chapter of this thesis, we have defined the concept of dominant logic and we have seen how the Good-Dominant Logic has so far been the most prevalent perspective in value creation. In contrast to G-D logic arises the Service-Dominant Logic (Vargo & Lusch, 2004, 2008) which proposes that the value is created through the integration of operant resources, (typically intangible: skills, knowledge, cultural resources, social resources) acting on operands resources (which are defined as tangible: goods, materials, products, outputs of projects) to obtain the value "in use". As a result of this theorizing, customer orientation becomes a key strategy in value creation (Mickey Howard and Dr Nigel Caldwell, Smith, Maull, & CL Ng, 2014).

In contrast to G-D logic, which holds that the value is "delivered" to the customer through a value proposition that is accepted in the purchase. From the perspective of S-D logic the proposition that the firm makes must be understood as a proposition of "potential" value or resource for the customer. Later, the customer through its operant resources and through the use or consumption is able to determine, perceive and obtain that value (Vargo & Lusch, 2004, 2008).

Thus, the value is co-created between firm and customer integrating the operands and operant resources produced by interactions and consumption practices. The process will be intimately linked to the context in which it occurs (Warde, 2005). These kind of interactions are facilitated through activities such as provision of services (Arnould, Price, & Malshe, 2006).

Factors such as co-production, customization or interactivity are critical for a service-centered perspective, where the consumer and relations with him are placed in a privileged place (Vargo & Lusch, 2004)

The way to compete from this new perspective changes and no longer depends just on the company but on the entire system (manufacturers, suppliers, investors and customers). Special attention requires the development of relationships and dialogue with the customer, as customer and firm jointly participate in the process of value creation (Figure 3.1) This new way to compete implies a big challenge in Strategic Management, because new strategies are needed to facilitate continuous and customized interactions with customers (Prahalad & Ramaswamy, 2004).

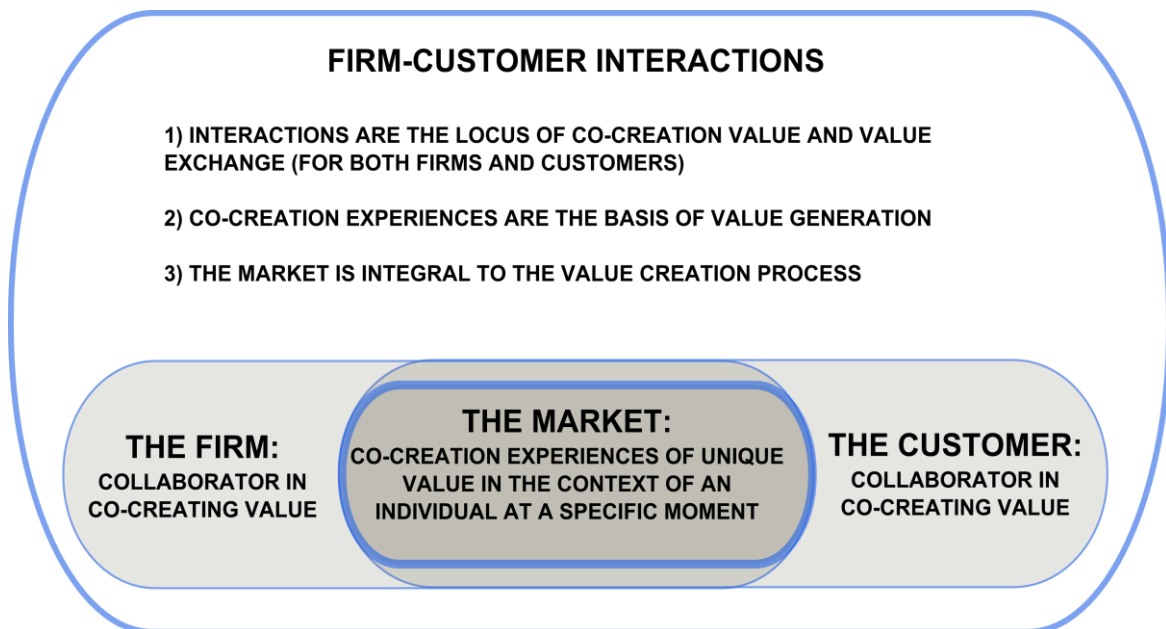


Figure 3.1: “Firm-Customer interactions and Market from the new perspective of Value Creation”. Adapted from: (Prahalad & Ramaswamy, 2004)

In short, a change from a firm-centric view to a customer-centric perspective in value creation is happening and this requires complete a process that will not always be easy to carry out.

3.2.2 Customer in the focus of value creation

We have been observing that from this new perspective of value creation, the customer becomes an active element. This change completely transforms the relationship between customer and company (Table 3.1).

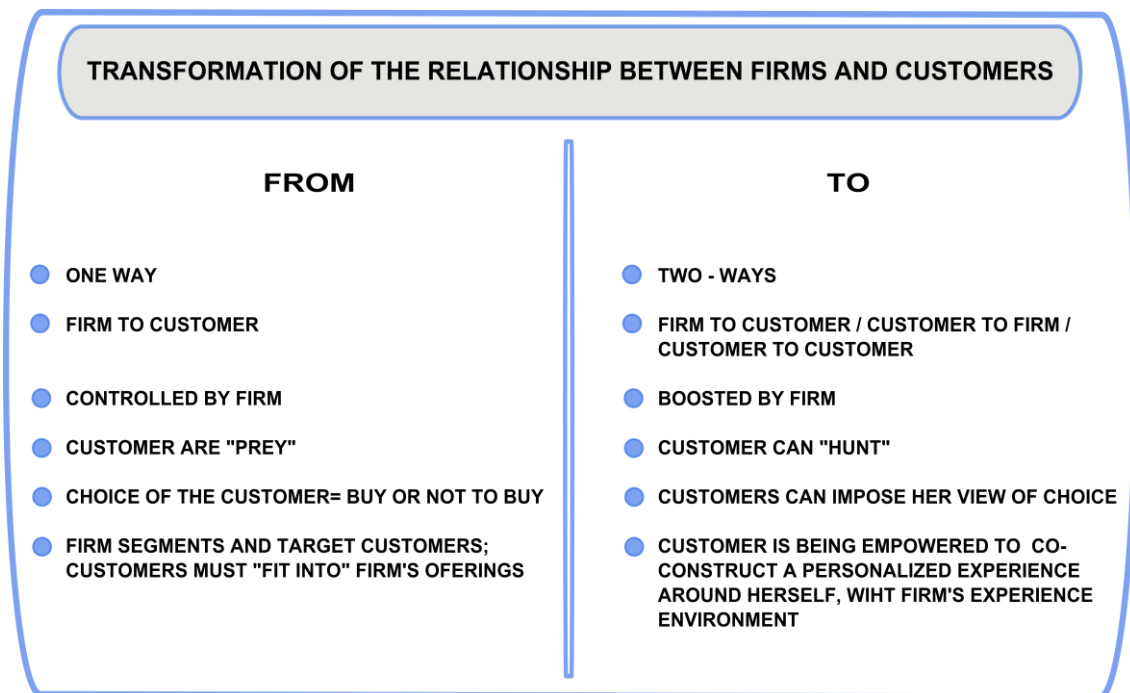


Table 3.1: "The transformation of the relationship between firms and customers as a consequence of the new conception of value creation". Adapted from: (Zhang & Chen, 2008)

On the other hand, the irruption of new information and communication technologies is causing increasingly connected, informed and active customers, with improved skills to analyze and enhance value creation. The increased connectivity between consumers also provide them a wider knowledge and a greater amount of information (Prahalad & Ramaswamy, 2004)

Is also important to differentiate how from the S-D logic, the client is considered a co-creator of value, not simply a co-producer. The difference is that as a co-producer, the customer helps the firm in the development of the offer that is launched to the market, while as a co-creator, the client "collaborates" in the creation of value with their skills and through the use of a

product or service (Ng et al., 2010). Thus, the customer enters into the system of value creation. This evolution in the role assumed by the client in value creation from being an external element to be an active element requires to find activities which allow the customer to participate in the process (Xiang & Rongqun, 2006). In addition, it also remarkable that in co-creation process customer participation should be systematic and as continuous as possible through varied interactions. The emphasis on the quality of customer-firm interactions is a key factor, since it will allow converting the knowledge, experiences and skills of customers in potential competitive advantages (Xiang & Rongqun, 2006).

In this new system of value creation, the firm becomes the nerve center of the value creation network (Wikström, 1996). Companies manage and coordinate interactions with customers seeking a win-win situation for both costumers and firms.

Nevertheless, this system also requires investing on significant resources (time, money and technologies) to understand better the use experiences of costumers and be able to obtain useful conclusions and practices (Buttle, 2009).

3.2.3 Customer – Firms interactions

A key aspect in customer-centric value creation is the interactions that have to take place between firm and customer (Parry, Bustinza, & Vendrell-Herrero, 2012). These interactions should fulfil some characteristics in order to allow achieving new competitive advantages.

(Prahalad & Ramaswamy, 2004) propose some fundamental elements to characterize these interactions:

- (1) Dialogue: The importance of dialogue resides in enabling a smooth and articulated communication between firms and customers.

Through dialogue will be easier to find common interests and solve problems together

- (2) Access: understood as provision of the necessary tools to the client for participating in the co-creation process in an autonomous and independent way.
- (3) Transparency: involves the disappearance of asymmetric information that firms traditionally had. The trend now is to share with clients certain information concerning the company, its operations and activities.
- (4) Risk-Benefit assessment: as a result of transparency, dialogue and access, the customer finally gets reliable and accurate information that helps them to better evaluate all their decisions related to the company.

All this can be summarized in the following figure (Figure 3.2):

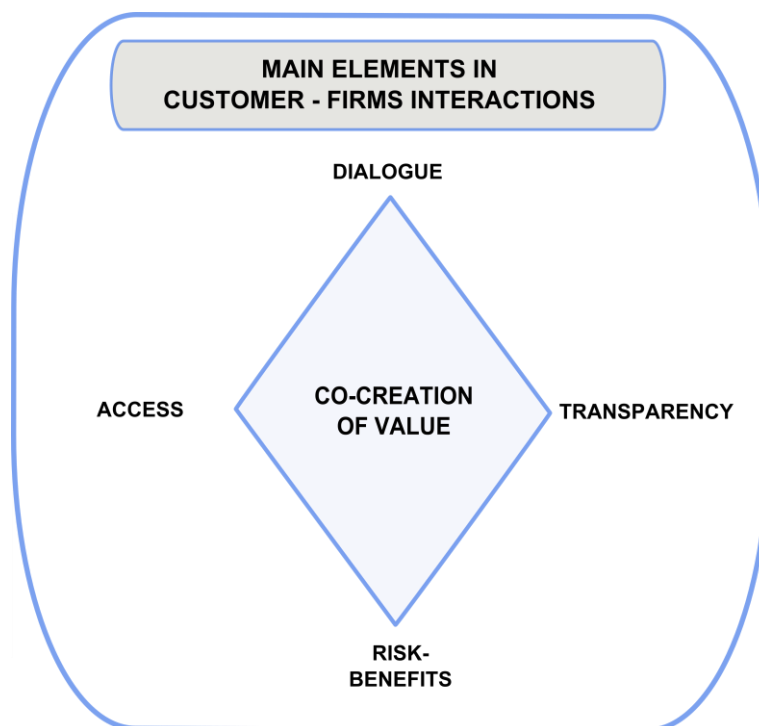


Figure 3.2: “Main elements in Customer – Firms interactions”

3.2.4 Value Chain from S-D logic perspective

This new perspective of value creation has also implications in the management of the value chain. In the second chapter we have analyzed the value chain from the perspective of the traditional conception of value. Now, we are going to study some of the impacts of the new dominant logic in the value chain.

The traditional conception of the value chain was mainly focused on production, leading the competition only in certain stages of the chain. However, from the perspective of the Service-Dominant Logic, the objective is to generate value along the chain as a whole, including also customers and suppliers network (Choi & Kim, 2008).

Thus, the main goal will be to generate new synergies between the different actors involved in the value chain, and this is facilitated through mechanisms of co-production and co-creation of value with the customer (Prahalad & Ramaswamy, 2004).

In the pursuit of that goal, companies are oriented towards the relationship with the customer, introducing innovations in the interaction methods such as: provision and integration of operational resources, identification of the various options for value co-creation or visualization tools for making sense of the value generated (Lin, Wang, & Yu, 2010)

The competitive strategy is based on the information obtained from customers through the mechanisms of interaction (Xiang & Rongqun, 2006). Under this premise, the goal is to try to generate the maximum value through a value chain which is able to be reconfigured through continuous interactions with the customer. A proper implementation of the value chain following the S-D perspective can establish itself as a source of competitive advantage (F. Bustinza, C. Parry, & Vendrell-Herrero, 2013)

3.3 NEW STRATEGIES OF VALUE CREATION

There are a several management strategies that are born as a result of the new conceptualization of value. In this part we will highlight some of the most important.

3.3.1 Co-creation

The implementation of this strategy is basically focused on the development of actions that allow us to achieve a better understanding of the experiences and expectations of customers. Through this strategy, firms try to introduce the customer in the process of value creation (Grönroos, 2011b; Payne et al., 2008)

By following co-creation strategies, customers are driven to participate in the dialogue with the company in the design, production and delivery stages. This dialogue should be understood as an interactive process of learning together (Ballantyne, 2004). The co-creation of value allows companies to improve customer acquisition process and above all, to identify their motivations and desires (Lusch & Vargo, 2006).

Firms and providers have the opportunity to create value through personalized and co-produced offerings. The co-creation of value is a desirable goal because it can help businesses to highlight the customer point of view and improving the process for identifying customer needs and desires (Lusch & Vargo, 2006). To properly develop this strategy is very important to know what customers seek and obtain during their participation in that process.

A better understanding of what co-creation is can be obtained in the next table (Table 3.2).

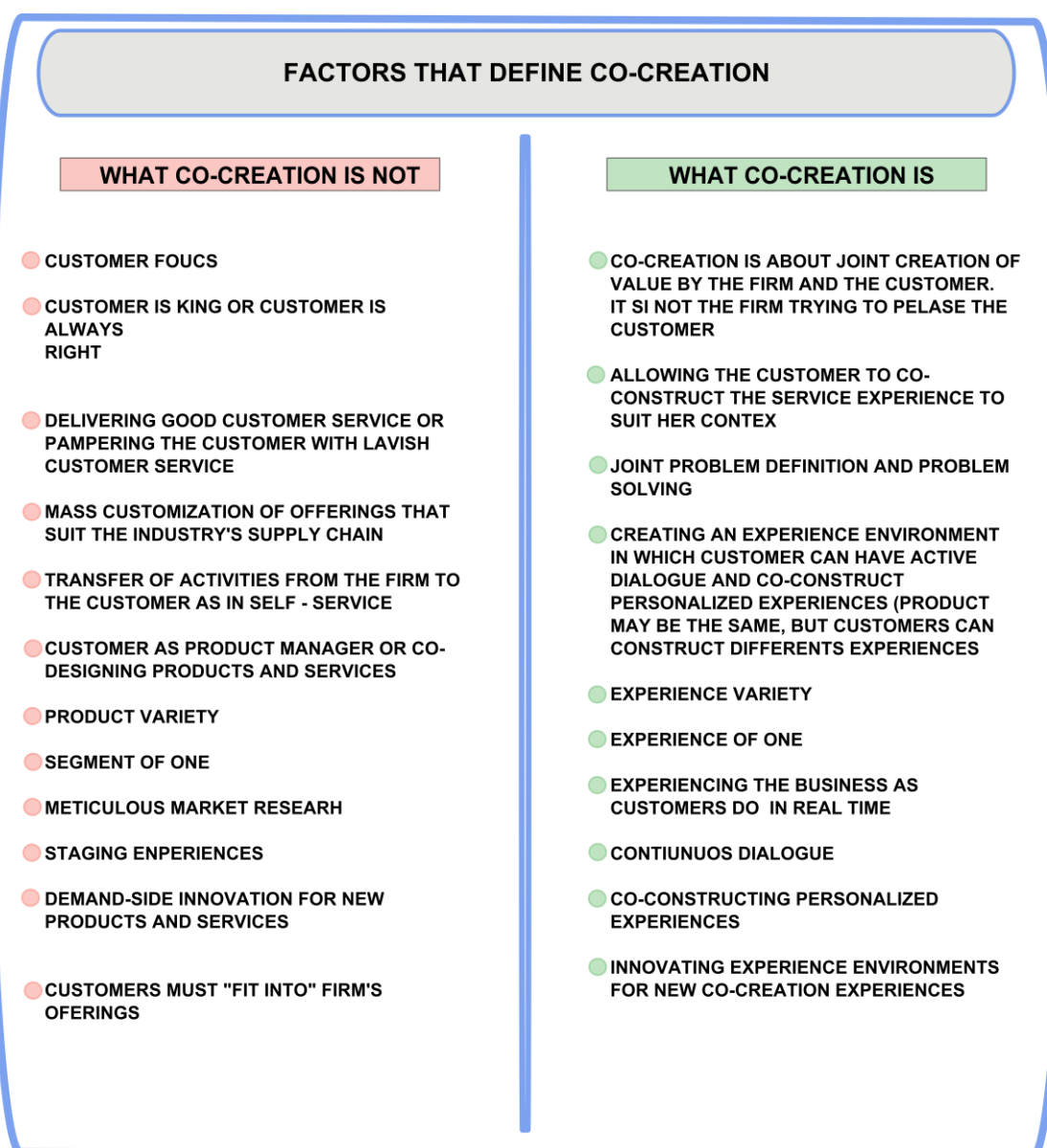


Table 3.2: "Factors that defines what Co-creation is". Adapted from: (Zhang & Chen, 2008)

The process of interaction with the client in a co-creation strategy is characterized by three main elements: emotion, cognition and behavior. Through understanding these elements, firms can adjust their interactions, seeking to improve the consumption experience and the learning process. On the other hand, advances in technology enable the emergence of new ways of interacting with customers to co-create innovative products and services (Cui & Wu, 2015; Payne et al., 2008)

The interactive nature of co-creation process challenges traditional practices in value chain management. This strategy requires the participation of the "extended enterprise" and a long-term vision for a successful implementation. However, sometimes these requirements do not fit with the shortsightedness of current market in developed economies (Lemke, Clark, & Wilson, 2011)

Finally, it has been emphasized the importance of building new communication methods to engage customers in the process of value creation and even "teach" them how to improve their ability to co-create value. That is why firms look for methods that increase interaction and dialogue with the consumer before, during and after the act of purchasing or contracting (Jaworski & Kohli, 2006).

A successful adoption of co-creation can allow companies to maximize the value and increase the duration of relations with their target customers (Payne & Frow, 2005).

Examples of these methods are consumer clubs, loyalty programs, support programs to improve the use of products, centers of expertise (Mercedes Benz) combinations of products that improve the experience of end use (Nike and Apple) etc. (Payne et al., 2008).

3.3.1.1 Discussion of Co-creation

As we have studied above, the co-creation can be observed as a positive and desirable process. However sometimes, it remains unclear how companies use properly their resources and work in the right direction to achieve that objective. It is easy to reach the conclusion that often companies believe that the co-creation process happens "per se" (when and how the firms want) just by making available the appropriate communication channels. Sometimes firms forget the key role of the customer and above all, his individual freedom to

cooperate or not cooperate in the process of creating value for products or services.

Thus, the aim should be to try to maximize the potential benefits of customers for their participation. A priority line must be to encourage clients to participate in such a beneficial process through different incentives (rewards, recognition, prizes). If not, the motivation of customers to participate co-creation process could decrease or even disappear. (Galera-Zarco, 2011)

3.3.2 Customerization

Customerization can be defined as value creation together with customers through dynamic interactions given in the provision of products and services (Wind & Rangaswamy, 2001). This strategy is very important for the inclusion of services that may be associated with products (Sanchez, Parry, Vendrell-Herrero, & Myrthianos, 2015; Zhang & Chen, 2008).

Customerization strategy arises as a great opportunity to introduce clients on the value creation network. Through customerization, interactions with customers allow not only making customized offers, but also allow developing jointly operational capabilities (Wind & Rangaswamy, 2001). Such strategies require improved interaction methods. In fact, companies are starting to compete not only in providing the best product or service, but also to be the best at meeting customer expectations in all stages of product development or service provision (Whiteley & Hessian, 1996).

Customerization seeks to offer customizing products and services to "engage" customers with brands. The connection with potential customers has become a key part of business strategies, but now the key issue is to get an actual association between client and brand, product or service through a positive personal experience (Wind, Mahajan, & Foreword By-Hagel III, 2001). To achieve this objective, firms have explored various ways, including one that seemed insurmountable because of the costs involved: personalization of products and services. However, thanks to the expansion of digital tools, the

customization processes are increasingly become economically affordable and are showing high rates of success in the results (Paolucci, 2014).

Major brands have already developed campaigns to offer their customized products: Nutella and Coca-Cola launched campaigns offering customized labels and cans, Nike and Adidas have developed online tools for customization of their products or Lego, which is allowing its customers to design customized bricks.

The above examples make clear the importance of connecting with customer emotions to engage them with the brand. This is based on what we define as acquired value from customer experience.

3.4 IMPLICATIONS OF THE NEW CONCEPTION IN VALUE CREATION

The adoption of these new strategies implies an increase in interactions with customers, resulting in a smooth and close communication which brings as a result a better understanding of needs and preferences of customers. Hence, companies are willing to provide customers with products and services which match better with their likes (Ng, Scharf, Pogrebna, & Maull, 2015). In addition, a better understanding of what gives value to the customer allows firms to optimize certain processes, as they can identifying easily which activities or product / services characteristics do add value for the customer and which not (Osterwalder, Pigneur, Bernarda, & Smith, 2015).

On the other hand, consumer involvement in the process of value creation can bring other implications related with the new kind of established relationship. Thus, appear phenomena such as loyalty, co-production and identification (Vargo & Lusch, 2004).

3.4.1 The concept of identification

One of the findings that we provide as a result of our review in this chapter is the establishment of a relationship between the co-creation of value and the process of identification.

The co-creation of value implies long relationships between firms and customers (FitzPatrick, Varey, Grönroos, & Davey, 2015). The continuous interaction and the capacity to influence on key decisions about the products and services offered by the firm, make customers feel more and more integrated into the firm, perceiving some of the offered products or services as "made for them" (Leventhal, Mascarenhas, Kesavan, & Bernacchi, 2006).

The development of consumerism and the growing influence of large corporations on society facilitate the role of companies as social identities for consumers looking to fulfil their self-definition (Pratt, 1998). Thus, customers can become attracted to the identity of a company, especially if they are able to identify elements of their own identity in the identity of the Company (Rao, Davis, & Ward, 2000).

The evolution of interactions between customers and firms, which is moving from a mere economic exchange into more continuous and long-term relationships (Scott & Lane, 2000) will inevitably facilitate this phenomenon of identification. By achieving the identification process, the company could access to several competitive advantages (Bhattacharya & Sen, 2003):

- (1) Firm Loyalty: it is considered as one of the consequences of the identification process. Identified consumers acquire the commitment to increase the welfare of the firm (Dutton, Dukerich, & Harquail, 1994), leading to a loyalty both to currently offered products / services and to new proposals that the firm will launch the market.
- (2) Firm Promotion: Identified customers show a trend to communicate positive information about the Company (Ashforth & Mael, 1989). This

implies that the higher customer identification with a firm is, the better the positive promotion for the company will be.

(3) Customer recruitment: identified customers, in their quest to work for welfare of the company with which they are identified, also assist in attracting new customers (Bhattacharya & Sen, 2003)

(4) Resilience to negative information: customers who share the values of the company are less prone to negative information about the company (Alsop, 2002) and disappointments for the launch of new products that do not achieve their expectations (Chappell, 1993).

In view of the above, the importance of the phenomenon of identification and the need to harness its power seem obvious. So far managers looked for the ways to reach customer identification with their companies. The new paradigm of value creation and the momentum of strategies based on it appear as a very interesting way to be explored in order to exploit this phenomenon.

CHAPTER IV

SERVITIZATION

4.1 INTRODUCTION

The notion of value in use and its different strategic implications lead companies to a greater orientation towards services inclusion. (Bustinza, Bigdeli, Baines, & Elliot, 2015)

Although sometimes it is quite complex differentiate production activities and services, from a procedural point of view, can be identified several characteristics of services: they are heterogeneous, simultaneous, perishable, intangible and require contact with the customer (Metters & Marucheck, 2007).

Precisely, interactions with customers in the process of providing a service can be considered as one of the most important differences between production and services (Sampson & Froehle, 2006). Development of lasting relationships between the customer and the supplier is an intrinsic characteristic of services (Rifkin, 2000), which, as we will study in this chapter, links services with new strategies to generate value.

4.2 DEFINITION & IMPORTANCE

Servitization strategy is mainly based on the addition of services to the traditional firm offerings (Vandermerwe & Rada, 1989) and is changing the strategic way in which companies are competing in the market. Servitization can be also defined as the transformation from selling products to offer complete solutions (Baines et al., 2007).

This transformation is particularly affecting OEMs, whose role is changing from its original perspective of being manufacturers to become service providers (Roy et al., 2009). However the study of Servitization should not be

limited to industry and manufacturing, and it is being studied its applications in other sectors (Aquilante, Bustinza Sánchez, & Vendrell-Herrero, 2016; Chacon & Aranda, 2014), including PBFs (Kelly, Morledge, & Wilkinson, 2009)

There have been many studies on organizational changes to successfully implement the Servitization process (Bastl, Johnson, Lightfoot, & Evans, 2012; Brax, 2005; Davies, Brady, & Hobday, 2006; Demeter, Boer, Priya Datta, & Roy, 2011; Gebauer, 2008; Vendrell-Herrero, Myrthianos, Parry, & Bustinza, 2015). However, there is considerably less literature based on the processes involved in managing strategic change, a key factor for the implementation of Servitization that we will discuss in this chapter.

4.3 VALUE CREATION IN SERVITIZATION

Servitization process implies a stronger customer orientation and a change on the traditional conception of value creation by following service dominant logic, understanding that the value is not embedded in products but realized during their use (Vargo & Lusch, 2004).

One of the main objectives of Servitization strategy is to develop lasting relationships with customers. That is the reason why companies put the focus on improving the care of the end user and try to fulfil the expectations of increasingly informed and connected customers with also are showing greater needs of customization (Vandermerwe & Rada, 1989). Thus, we can hold that Servitization is closely related to the co-creation of value (Ng et al., 2010)

4.3.1 Types of Services

It is clear that servitization is based on the provision of services. However, services can be categorized regarding their complexity orientation and value proposition (Figure 4.1). In this sense, (Baines & Lightfoot, 2013a) establish a classification of services:

- **Base Services:** mainly based on delivering products and their spare parts.

- **Intermediate Services:** These are services aimed at the general maintenance of a good delivered.
- **Advanced Services:** Deliver a “capacity” to customers through the performance of the goods supplied. They are focus on the operation of the goods delivered.

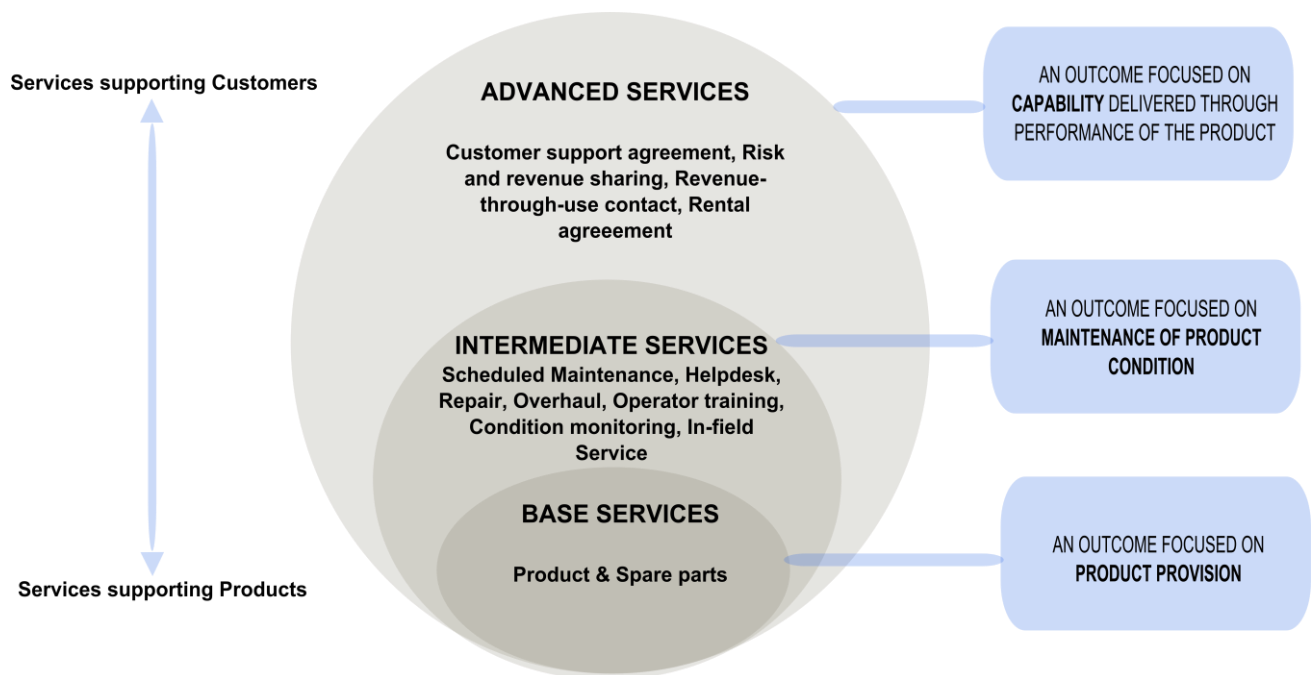


Figure 4.1: “Taxonomy of Services”. Adapted from: (Baines & Lightfoot, 2013a)

4.3.2 Advanced Services

Advanced services play a key role in the development of servitization strategies. These services offer "solutions" based on products / services that in some occasions affect basic skills of customers, which involves a redefinition of the boundaries between the activities carried out by the customer and the service provider (Baines & Lightfoot, 2013b).

Advanced services have a series of common features that help to recognize and define them: (Baines, Bigdeli, & Galera, 2016b)

- Long-term contracts: contracts lasting between 5 and 15 years are common
- Risk management: the service provider assumes the risk derived from a malfunctioning of the goods supplied
- "Pay per use" methods as usual means of obtaining incomes: "pay per click", "pay per hour", "pay per km".
- Commitment to continual improvement of operations processes (my paper)

When these features are combined with the aim of offering the customer a "capacity" through the operation of a good, we can speak of providing advanced services.

4.4 TRANSFORMATIONS THAT SERVITIZATION IMPLIES

Servitization process involves a series of important transformations for both clients and companies.

Under the adoption of servitization underlies two key aspects (Kamp, 2016):

- A diminishing interest in the ownership of the goods: customers can not to require the purchase of a good, but they could prefer to pay for the use, or for obtaining skills related to the use of a good.
- The reconfiguration of the relationship between user and provider: relations become supported by continuous interactions and assistance from provider to user during operation of goods. There is a shared risk-reward balance that links clients and providers in the common goal to operate correctly and increase life cycles.

4.4.1 Organizational implications

The adoption of Servitization involves organizational changes both supply companies and customers. These changes primarily affect organizational culture, personnel management and internal processes (Martinez, Bastl, Kingston, & Evans, 2010).

Another important organizational change comes from the need for adoption of new information and communication technologies, which must be able to provide information about the condition, location and property use of goods through which the services are provided (Lightfoot, Baines, & Smart, 2011).

All these changes require time, and normally the complete transformation is carried out after several years.

4.4.2 Factors enabling the adoption of servitization strategies

In this section we will try to determine a number of factors that motivate consumers and providers to develop Servitization strategies.

If we look at the strategic objectives, there are basically two kinds of reasons for both customers and suppliers when adopting Servitization (Baines et al., 2016b):

- **Defensive reasons:** Defending their commercial viability and business efficiency. Improve the predictability of revenue and payments flows and payments and to hinder competition. Servitization also seeks to help companies develop innovations in their products and that these innovations acquire dissemination and market acceptance. Customers basically seek improvements in security and reliability of goods and its operation.
- **Offensive reasons:** Improving business competitiveness and growth .Some clients also adopt services supplied from OEMs to boost their focus and investment on their key capabilities. Many customers use

servitization to avoid secondary problems from other activities that are not linked with their core competencies.

4.4.3 Facilitators and inhibitors in Servitization

Another important point to study in Servitization is to identify factors that facilitate or inhibit the adoption of advanced services for both clients and suppliers (Baines & Shi, 2015).

4.4.3.1 Inhibitors for clients

From the clients' point of view, there are several factors that cause resistance in adopting servitization strategies. Mainly this inhibition takes place when clients do not feel comfortable in hiring advanced services for different reasons (Baines et al., 2016b):

- Being afraid of excessive reliance on the service provider, which make them fear difficulties in obtaining good price-quality ratios
- Existence of a wide range of providers offering the same services and alternative technologies
- Easy replacement of goods associated to the service (in case of fault, failure, obsolescence)
- Lack of senior leadership support for adopting decisions towards outsourcing
- Legal complexities related to contracts, data management, and data collection processes

- Lack of qualified personnel to understand and manage the process of strategic transformation
- Lack of information on Service Levels, which ends up causing a lack of perceived value

4.4.3.2 Facilitators for clients

However, there are other factors that make customers show their willingness to adopt advanced services (Baines et al., 2016b):

- Confidence in finding the right fit of services within the organization
- Ability for monitoring cost-benefit ratios arising from the adoption of services. It allows clients to quantify and perceive the value they are receiving.
- Relying largely on your service provider

4.4.3.3 Inhibitors for services suppliers

Suppliers share some inhibiting factors with customers. Most are concerning to legal aspects of the contracts, data management and finance. These factors are especially critical for smaller companies.

Those suppliers who show a strong policy towards the adoption of the Servitization and delivery of advanced services have a series of more specific inhibitors (Baines et al., 2016b; Lienert, Elfving, Washington, & Wilkens, 2014):

- Problems relating to intellectual property of technological innovations
- Concern about their know-how and their know-why

- Problems to make value perceivable and measurable for their customers

4.4.3.4 Facilitators for services suppliers

For suppliers, the most prevalent factors that make them adopt servitization strategies are (Baines et al., 2016b):

- A strong and stable relationship with its clients based mainly on trust.
- Stable and strong relationships with their own suppliers
- Security in the quality and good reputation of their products
- High capacity for innovation and for providing services tailored to the needs of each client
- Ability to manage strategic change that involved the adoption of Servitization

4.4.4 Benefits derived from Servitization

Research has shown that servitization delivers differentiation (Baines & Lightfoot, 2013a) and customer satisfaction (Raja, Bourne, Goffin, Çakkol, & Martinez, 2013), but beyond it can be observed some real benefits derived from Servitization.

4.4.4.1 Benefits for Clients

Customers can obtain some important benefits from adopting servitization (Baines et al., 2016b):

- Significant improvements in asset management, risk management and finance.
- Initial costs savings together with an increased safety and reliability of goods.

This allows them to focus on the activities that they consider fundamental to their business. Otherwise, clients get Access to more advanced technologies and improvements that lead them to achieve better results in safety and environmental sustainability (Neely, 2008)

In addition, these services have enabled a structural change that would have been more difficult to achieve by the client on his own. All these transformations are reflected in efficiency improvements in business performance and in higher efficiency on their activities (Ha, Lee, & Kim, 2016).

Among customers, the main adopters have experienced significant reductions in their costs by hiring advanced services. This reduction is estimated at around 25-30%. Although there is not a lot of data, it seems clear that significant savings are being achieved.

4.4.4.2 Benefits for services suppliers

Service providers can obtain improved commercial viability through various impacts (Baines et al., 2016b):

- More uniform revenue streams
- Entry barriers for competitors

- Increased life-span of goods

- Greater proximity to clients, increase in the number of customers and entry of new customers

- Easier inclusion in the market for product innovations and new processes.

- Improvements in product designs

- Increase in the number of customers, markets and development of new market research.

Growth achieved thanks to existing customers has been possible by achieving greater intimacy based on narrower and strong customer-supplier relationships. On the other hand, they have created new market opportunities. For example, services such as Rolls-Royce Total Care have supported the creation of Low Cost airlines, because the emphasis of maintaining the product can be now an issue of the service supplier. In addition, some clients have also benefited from the development of new products / services, such as the new track generation launched by MAN Truck & Bus UK.

For some suppliers, especially OEMs, the transformation to focus its activities on selling products to offer a variety of services has enabled them to improve their competitiveness, which is being translated into increased incomes (5-10% annual) and greater ability to face difficulties.

4.5 DIFFICULTIES IN IMPLEMENTING SERVITIZATION

The study of the difficulties associated with transformation process that involves servitization is a complex issue. The main difficulties observed in this process come from the organizational difficulties arising from the lack of process understanding from senior management, this is mainly due to their lack

of culture of outsourcing (Arias-Aranda, Bustinza, & Barrales-Molina, 2011; Bustinza, 2008; Glaister, Liu, Sahadev, & Gomes, 2014) Another major stumbling block is in the lack of capacity to deal with services and to develop the necessary technologies and information systems for a successful implementation of this process. (Dickson, Ford, Neu, & Brown, 2008; Gebauer, 2008; Oliva & Kallenberg, 2003)

On a more particular way, customers observe some dangers associated with servitization such as:

- Reductions in their own capacity for innovation and development of new technologies (Kastalli & Van Looy, 2013)

- Reductions in the number of employees. This is controversial element, but in some cases may inhibit the adoption of this strategy (Aspinwall & Elgharib, 2013).

Suppliers (OEMs), for their part, reduce their more common revenue streams, as was the sale of products and look towards a transformation that makes them more stable and sustainable.

4.6 POTENTIAL OF SERVITIZATION IN GLOBAL ECONOMY

Servitization development is occurring primarily in developed economies. One of the challenges it faces is to know whether servitization can foster economic growth. We have previously observed that some economics results begin to be quantifiable, mainly in cost savings for customers, and increased benefit derived from the provision of services in the case of manufacturers.

According to some studies a positive correlation between servitización and economic growth is being observed. (Clegg, Lightfoot, Baines, & Smart,

2013; Neely, 2008) However, it is difficult to determine how it affects the development of other kind of companies and its implications in job destruction (Michel, Brown, & Gallan, 2008).

There is some evidences that the adoption of servitización in advanced economies appears as a response to certain threats such as price competition from economies of developing countries (Roy et al., 2009). The servitización arises as an opportunity to achieve differentiation and restructure income streams (Neely, 2008). Servitization is being considered as positively correlated with regional and national growth (Vendrell-Herrero & Wilson, 2014). Since this process goes away from the most classic and widespread production model supported by sale of goods but moves towards a development based on innovation and technological capabilities of companies (Baines & Lightfoot, 2013b).

However, for the development of Servitization on a higher level, appropriate industrial policies to assist in overcoming the inherent barriers described are needed (Brax, 2005; Hou & Neely, 2013; Mont, 2002). On the other hand, the promotion of technological innovation and support for technological development that enables servitization is another area where government and supranational entities could play an important role (Lin & Lin, 2012). Another aspect that needs support is the training of qualified personnel with the necessary engineering and technological knowledge oriented to the creation and development advanced services (Gotsch, Hipp, Erceg, & Weidner, 2014).

CHAPTER V
BUSINESS DIGITZALIZATION

5.1 INTRODUCTION

In previous chapters we have observed as the co-creation of value and Servitization strategy require continuous and fluid interactions with customers in the search for a better understanding of user experiences, as well as to gain knowledge about the operation of goods delivered. Thus, nowadays firms are seeking to understand better customer experiences, uses of products and operation / performance of systems and projects.

In this context, new technologies, and particularly; monitoring technologies, connectivity advances, storage capacity and digitization play a key role as the great enablers to offer advanced services based on new strategies of value in use (Grubic, 2014).

At the present time, it has been observed a strategic step towards achieving greater advantages from the process of Servitization, and also trying to avoid the paradox of services (Gebauer & Friedli, 2005). And at this point data and its associated information acquire a leading role. Technology becomes an essential tool in collecting data that until now were impossible to get, as well as enables at the same time the storage and data management (Baines & Lightfoot, 2013b). The ultimate goal is to extract key information and to reach conclusions that will be critical for new value creation.

This technological potential is based on concepts such as the internet of things (Kopetz, 2011), smart products (Kortuem, Kawsar, Fitton, & Sundramoorthy, 2010) cloud computing and big data. These concepts will be analyzed into this chapter.

5.2 COMUNICATION TECHNOLOGIES AS TOOL FOR VALUE CREATION

The use of technology in creating value from the S-D perspective began primarily as a tool to improve communication and interactions with the customers. However, in recent years, the great technological development mainly due to lower prices on sensors, an increased connectivity and bigger storage and analysis capacities have exponentially increased the chances provided for the implementation of advanced services and get access to usage data and consumer experiences. (Parry et al., 2015; Parry et al., 2012).

The initial objective in the use of technology for servitization strategies and co-creation of value was to promote interactions with customers. That is, to connect more easily customers and suppliers, through a fluid, direct and immediate communication (Chen & Popovich, 2003).

In fact, we can say that emergence of the Internet is one of the factors that influenced the implementation of co-creation processes. Thanks to development of the Internet, customers began to establish dialogue with firms and other users, and at the same time they start to learn from the experiences of other users (Prahalad & Ramaswamy, 2004). Consequently, a change from one-way communication and fixed channels, to a more dynamic communication, with greater interactivity and more variety of channels (Molenaar, 2002).

As the Internet became a more participatory environment, consumers started to play a more active role in value creation, emerging a simpler and more effective dialogue (Prahalad & Ramaswamy, 2000). This improved dialogue allows companies to access to a collective intelligence able to empower the process of creating value (McAfee, 2009). Likewise, the internet is presented as a tool for global and massive collaboration, which is very useful in the creation of value (Tapscott & Williams, 2007) Anyway, we should not forget that the use of new technologies does not mean "per se" co-creation of value,

but must be understood as a tool with great potential to achieve this goal (Galera-Zarco, 2011).

The choice of communication tools is a key factor for firms. The company may decide between use existing tools, to create a specific thematic platform or use both its own platform and other tools. The most sensible decision would be co-create experiences across multiple channels and platforms, as people often use many channels to communicate and also want freedom of choice. Prahalad & Ramaswamy (2004) hold that communication tools should meet the following characteristics:

- (1) Facilitate dialogue and access to different types of customers
- (2) A simple navigation through intuitive interfaces and ease of use
- (3) To allow exchange of audio, text, video, images, etc.

The use of communication technology tools must involve a proper management of them and an integration into the whole process oriented to co-creation of value inside the firm (Payne et al., 2008).

5.3 SERVICE-ORIENTED TECHNOLOGIES

Today, innovation in advanced services and value creation is oriented towards the creation of systems that are able to learn and adapt themselves in a dynamic way, basing its decisions on data collection and data processing (Grubic, 2014; Maglio & Lim, 2016; Medina-Borja, 2015).

To achieve this objective are emerging new technologies which are oriented towards the proposed strategic objectives

5.3.1 Monitoring technologies

The information and communication technologies now are taking an important place in different fields of application and in management of all types of organizations (Ponjuán Dante, 1998). Its importance in management has an increasingly important role and provides new techniques and management tools to improve processes and quality assurance functions within an organization (Aja Quiroga, 2002).

These new technological developments allow obtaining much more information in real time and in situ, providing organizations new management methods, which are also increasingly personalized and able to monitor assets (Grubic, 2014). The introduction of the Internet of Things (IoT), Cloud Computing (CC), and Pervasive Computing will enable organizations to generate new business models based on continuous monitoring of their assets, allowing them to control and improve their performance.

5.3.2 Internet of things

We have observed in previous sections as Internet can be considered the major source of information and a very important learning environment, not only because it contains a lot of information, but because it connects people and facilitates communication with each other (Adell & Castañeda, 2010). Currently, most Internet connections worldwide are made by devices used directly by humans (computers or any type of mobile devices) which enable and facilitate a final communication between people. This interaction (Tan & Wang, 2010) is defined as a Human-to-Human (H2H) communication. However, in recent years this "classic" internet model used for the interconnection of end-user devices, is evolving into a new Internet enhanced primarily by the integration and interconnection of mobile sensors that can communicate with each other and / or with human beings, extending the frontiers of communication by introducing the interrelationships of human-to-machine communication (H2M), and machine-to-machine (M2M) under a new

technological paradigm called "the Internet of things" (Miorandi, Sicari, De Pellegrini, & Chlamtac, 2012).

This new paradigm will allow an expansion in connectivity of information and Communications Technology (ICT) by introducing a new dimension; in addition to the already known "anytime" and "anywhere", we will witness connectivity for "anything" (Tao, Cheng, Da Xu, Zhang, & Li, 2014). (Figure 5.1)

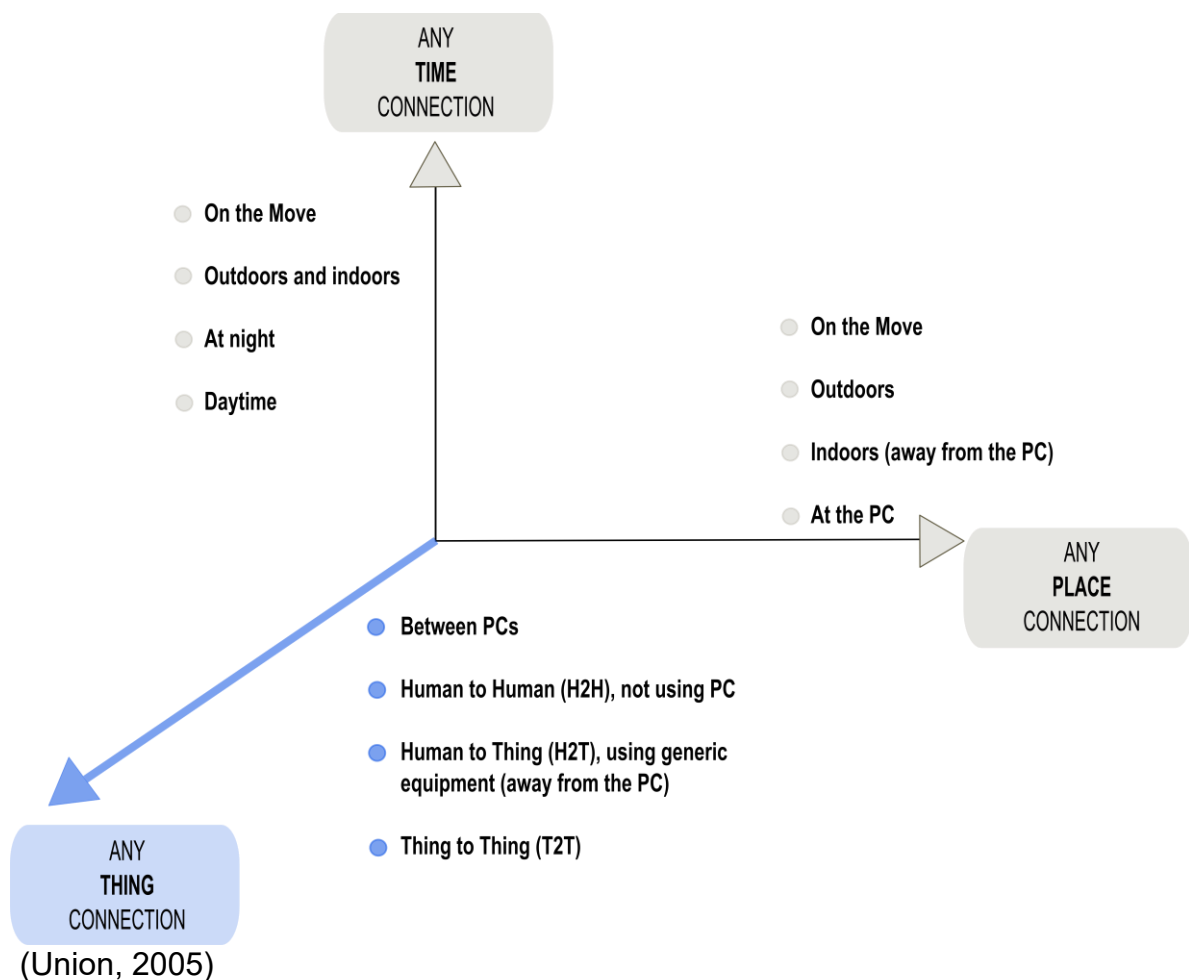


Figure 5.1: "The new dimension of connectivity: connectivity of anything". Adapted from: (Union, 2005)

This new paradigm envisions a global platform of interconnected objects (millions or billions of machines) that are not only able to obtain information from the environment (detection capability) and interact with the physical world

around them (trigger capacity / control / command), but also by using Internet protocols allows generating services that facilitate the exchange, analysis, use, and communication of such information (Gubbi, Buyya, Marusic, & Palaniswami, 2013). The main idea behind this new concept is basically the omnipresence in our environment of a variety of things enhanced with technologies such as radio frequency identification (RFID), wireless sensor networks (WSN), or wireless body area networks, body area (WBAN), which through IP addressing schemes facilitate cooperation between objects and people in order to achieve common goals (Atzori, Iera, & Morabito, 2010). This is possible thanks to the continuous developments we have witnessed in recent years in fields such as microelectronics and information and communications technology (ICT), which aim to make these technological advances part of our daily life. An example of this evolution are the constant reductions in price, size and power consumption of processors and other electronic components, thanks to that, these advances are being integrated more often in everyday objects. In this sense, it is expected that in the near future, the Internet of things enables a growing number of everyday products with hybrid features, it means, products capable of providing both conventional physical services and information services (Mattern & Floerkemeier, 2010).

As we have already described, the internet of things (IoT) refers to a network composed by millions of sensors which receive, collect, store, transmit and distribute large amounts of information. However, this huge quantity of sensors requires a technological infrastructure able to gather, organize, analyze and present this information. That is possible by using computing resources offered as services through a new technological concept called Cloud Computing (Aguilar, 2012).

5.3.3 Cloud computing

Currently, there is no a standard or universal definition for this new technological paradigm, however the most concise and largely recognized definitios is proposed by the National Institute of Standards and Technology (NIST), which defines Cloud Computing as a technological model that allows

ubiquitous access, adapted and on demand via the Internet to a set of configurable and shared computing resources (e.g. networks, servers, storage, applications and services). These resources can be provisioned and released with relatively small management effort and minimum interaction by the service provider (Mell & Grance, 2009). This new paradigm is rapidly transforming the way in which computing resources are distributed and consumed, offering customers and companies computing resources designed and managed as services (Wang et al., 2010; Wang & Lee, 2013), and reclassifying the use of computer systems, which are no longer an "investment capital" and become an "operating cost" (Venters & Whitley, 2012).

Thus, Cloud Computing offers a dramatic change, not only in the processing of information, but in all the informatics management by freeing companies from acquiring and managing IT resources, (i.e. hardware and software), reducing significantly investments in this concept. Thus, companies that transfer their computer equipment to the cloud has the possibility to implement the technology infrastructure that best suits their needs without the associated costs to maintaining an IT department within the Company. This advantage will allow companies to focus on the main, its core business. On this point, we could add other benefits associated with the adoption of Cloud Computing (López Jiménez, 2013):

- Tighter control on costs and benefits
- Greater resilience against potential disasters.
- Increased resources available
- Modernization of business processes
- Security, speed, scalability and flexibility
- Diversification of computer systems
- Assessment of viability and profitability of new potential services
- Mobility and full availability, without the need for physical space to store servers or databases

5.3.4 Pervasive computing

Ubiquitous or pervasive is a new technology trend from Computer Science, the focus is on that technology becomes part of a person's environment. For this purpose, arises embedded systems and wireless sensors in everyday objects, providing them with the ability to transfer information without discomfort or setbacks for the user (Favela et al., 2007). In this way technology is around human beings almost without them becomes aware that this technology is there to solve their needs. Mainly, ubiquitous or pervasive Computing seeks to merge the physical and digital worlds by creating Ambient Intelligence (Aml), another important technological development which promotes and enables the generation of sensitive-context environments. These environments are endowed with sensory capabilities, which provide continuous, non-invasive and reliable connectivity, while at the same time are capable of running new services with high added value (Cook & Das, 2012). So in environment gifted with Ambient Intelligence (Aml), people will be assisted by various systems of daily use, which will be able to interact with users in an invisible and anticipatory manner based on their behavior patterns, spending habits and regular activities. Here, we are going to define several technological developments regarded as essential for the creation of an environmental intelligence. These technologies are important because they represent the hardware support responsible for collecting and transmitting the collected information from the environment and / or people.

5.3.4.1 Radio-frequency identification (RFID)

A system of radio frequency identification (RFID) is a wireless tracking technology which using radio waves can identify objects automatically without human intervention (Yao, Chu, & Li, 2010). This technology allows us to manage, identify and track any object by using tags. RFID also endows "tagged" objects with smart capabilities and wireless connectivity, allowing them to transfer information at all times (Curtin, Kauffman, & Riggins, 2007). Storage

capacity and data transfer in real time (Mäkelä, Belt, Greenblatt, & Häkkinä, 2007), are qualities that make RFID a technological tool with a high potential.

5.3.4.2 Wireless sensor network (WSN)

A wireless sensor network (WSN) consists of a series of stand-alone devices with collaborative properties able to communicate and transmit information via wireless connectivity (Yick, Mukherjee, & Ghosal, 2008). This kind of networks are normally distributed in a geographic area of interest in order to solve a common task (Lounis, Hadjidj, Bouabdallah, & Challal, 2013). Its architecture consists of three main components: nodes, gateways and software. The nodes establish interface with sensors and are responsible for monitoring the environment, each node has wireless communication capabilities and the ability of processing obtained information (Akyildiz, Melodia, & Chowdhury, 2007). Once the data are acquired, they are transmitted wirelessly to the gateway, which can operate independently or be connected to a main management system (Legacy system), once there, data may be collected, processed and analyzed.

5.3.4.3 Wireless Body Area Network (WBAN)

A wireless body area network (WBAN) is a particular kind of network, which is based on communication between nodes of portable sensors, i.e., sensors operating in or around the human body in order to monitor vital parameters (Huang et al., 2009a). WBANs consists of various miniaturized sensors placed on the user's body, either, pasted onto the skin or implanted in tissues, from which signals are collected and transmitted wirelessly (physiological parameters) with aim to monitor the welfare of the user regardless of his location.

5.3.5 Big Data

The unstoppable growth of data generated by monitoring and pervasive technologies make necessary that companies continually strive to develop

filtering techniques, analysis tools (Figure 5.3) and data mining (Davenport, Barth, & Bean, 2012). The advent of smart products and services able to perform predictive actions through the analysis of large amounts of data presents Big Data as increasingly necessary tool (Cassina, Tomasella, Matta, Taisch, & Felicetti, 2007) .

As we have noted, the enormous amount of data generated with new technologies can be problematic (i.e. a monitored engine can generate 10TB of data in just half an hour), but at the same time these data represent a great opportunity for the development of new business strategies (Ferguson, 2013).

The concept of Big data make reference to different types of data (Figure 5.2): data generated by sensors (status gauges, registration, etc.), social data and data concerning the performance of the company (Dijcks, 2012).

Four characteristics, commonly known as the “4 Vs” characterize the notion of Big Bata: volume, velocity, variety and veracity (Russom, 2011). It is considered that Big Data is characterized by a large volume of data, an increasing speed of transaction, an increase in the variety of data, both structured and unstructured, and a complex veracity in determining the safety and quality of such data (Chen, Chiang, & Storey, 2012).

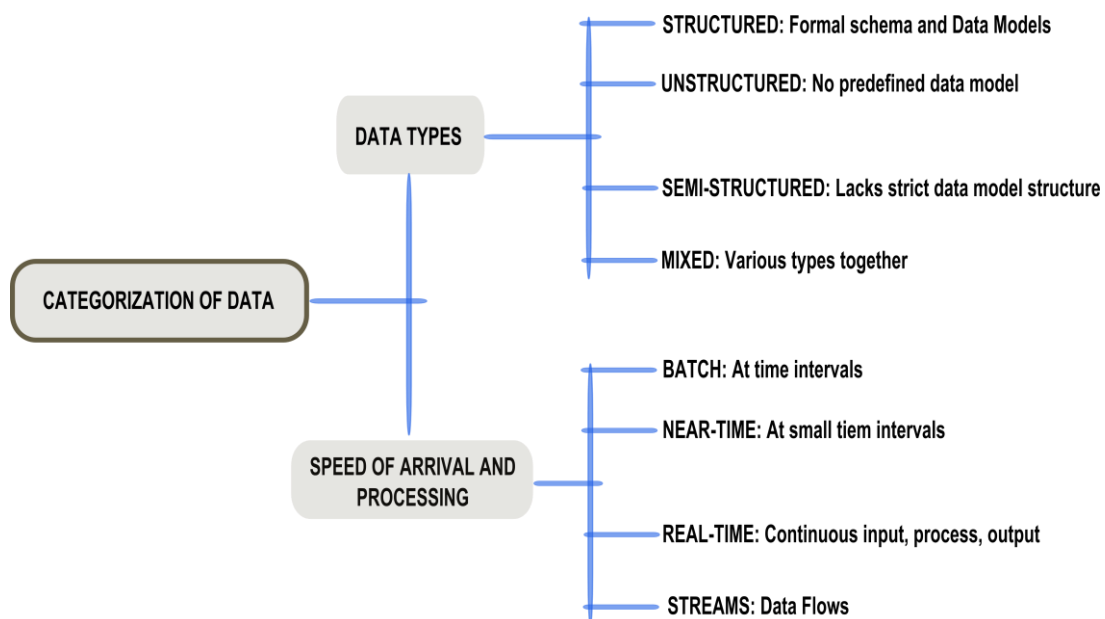


Figure 5.2: “Categorization of Data”. Source: Self-elaborated

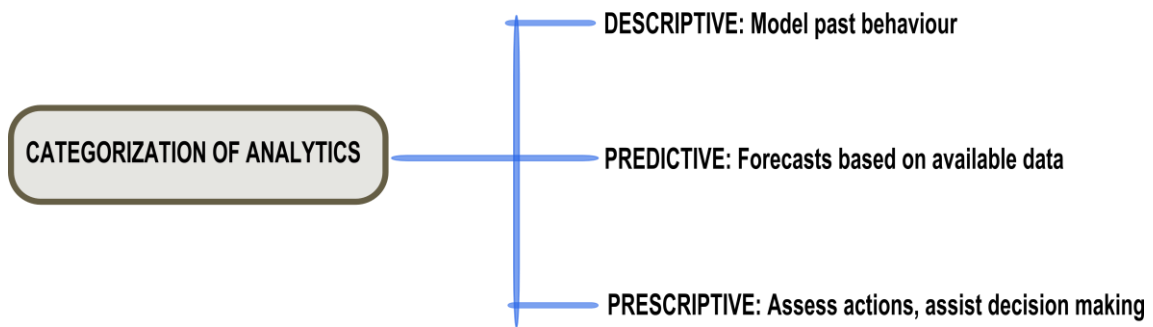


Figure 5.3: "Categorization of Analytics" Source: Self-elaborated

(Beulke, 2011) is the first author that adds "V" for value to the classic "4 Vs" of Big Data, it means that the value which can be extracted from the data becomes to be considered as a fundamental characteristic of Big Data. (Figure 5.4)

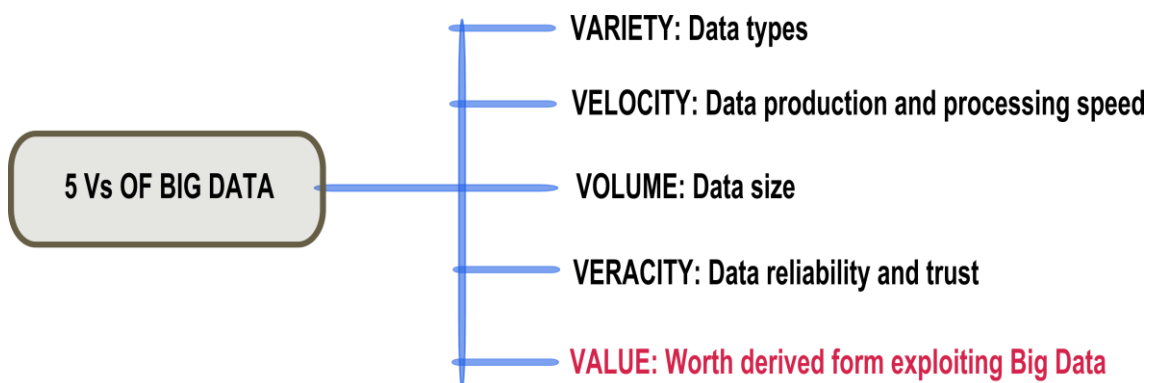


Figure 5.4: "The 5 Vs of Big Data" Source: Self-elaborated

From the point of view of firms, it is inevitable to face the problem about how to exploit these data and generate value from them. The literature defines two basic ways to generate value through the data: through by sale of data to third parties or becoming a manager of these data to obtain new information and (Madnick, Wang, Lee, & Zhu, 2009).

Thus, companies can now embark on the search for new competitive advantages through services or product-services which generate a large amount of data that can be analyzed, in particular, information concerning the use and customer experiences (Opresnik & Taisch, 2015)

5.4 VISUALIZATION TOOLS

We have analyzed how digitization technologies provide increasing amounts of data that must be analyzed. Therefore the use of effective visualization tools becomes a crucial factor (Assunção, Calheiros, Bianchi, Netto, & Buyya, 2015).

These visualization tools must take into account the quantity and quality of data. Another key aspect is the representation of the data, so visualization tools must increase a better understanding of these data and allow navigation through data (Davey, Mansmann, Kohlhammer, & Keim, 2012).

A right visualization allow executing three types of analysis: descriptive, prescriptive and predictive (Kosara & Mackinlay, 2013). Until now, many visualization tools were unable to provide advanced aspects to carry out deep analysis, but currently these tools are evolving to assist in predicting and in performing necessary analyzes by employing sophisticated techniques of "narration" and report emission.

Another aspect to consider for visualization of the data is that such interaction with data must occur in the cloud, to avoid bottlenecks in particular networks, that is the reason because visualization tools will should work in the cloud environments (HPC, 2013)

5.5 THE POTENTIAL OF DIGITALIZATION IN VALUE CREATION

Digitization emerges as a key element for the new perception of value creation, and in many cases is destined to play a lead role in the new way of doing business. The use of big data and data analytics can create value in

different ways. The customer data are converted into key information for value creation through smart and customized services (Saarijärvi, Kannan, & Kuusela, 2013), the design of new services or the implementation of improvements in existing information (Maglio & Lim, 2016). Through data analysis, companies can understand better the behavioral patterns of users (Boyd & Crawford, 2011), as well as to understand what drives customers to make certain decisions or behave in a certain way (Huang & Rust, 2013). The key advantage lies in getting all the information from the analysis of a large volume of data.

In general, depending upon data types, the source from which they come (customers, objects, environment) and how data are been collected (collective or individually) we can distinguish several benefits from business digitalization affecting different business areas; these benefits can be classified into four key areas: (Maglio & Lim, 2016)

- Smart Operations Management:

The smart operations management is based on data from products (i.e product status, environmental conditions or event log), which are analyzed and used in the management of more complex goods (e.g. infrastructures, vehicles, traffic lights, machinery). Ultimately, the objective is to improve the effectiveness of different operating processes through integrated monitoring and control. Some examples analyzed show the use of these systems in the management of complex machinery (Lee, Kao, & Yang, 2014); smart garbage collection (Purohit & Bothale, 2012) or smart traffic management in cities (Djahel, Doolan, Muntean, & Murphy, 2015)

- Customization and prevention

Other benefits are related to smart prevention and customization. In this case the data used pertain to people (behavior, purchase history, health, etc.) and are used in improving functioning of objects. This category encompasses all those smart systems designed to understand better habits and needs of people. Once analyzed data collected, these systems are able to customize its operation of these performing specific functions or preventing certain problems. Some examples are: the analysis of nightlife in cities for designing urban

transport networks and taxi stops (Farkas, Feher, Benczur, & Sidlo, 2015); systems that try to predict crimes based on problematic areas and crime rates (Caragliu, Del Bo, & Nijkamp, 2011; Kitchin, 2014).

- Smart coaching

Smart coaching applications are based on collecting data from people to develop systems aimed at improving aspects or routines in people lives. In this category we find systems that offer advice or are based on a better understanding of human behavior and the contexts in which certain actions are performed. Examples are: tools that increase efficiency in sport or intellectual training (Avcı, Bosch, Marin-Perianu, Marin-Perianu, & Havinga, 2010) health-oriented applications (Paschou, Sakkopoulos, & Tsakalidis, 2013).

- Smart Adaptation and Risk management

In this case the data collected come from goods or systems which are used in strategies to improve the performance of people lives. The aim is to analyze data from objects that have influence on the realization of human activities. Analyzing these data, try to adapt the behavior of those system to facilitate some activities and manage better some risks. Examples are: smart navigation systems, real-time fleet management in transport (Thong, Han, & Rahman, 2007); different systems integrated into Smart cities (Chourabi et al., 2012) or systems in construction processes (Halfawy & Froese, 2005).

5.5.1 Main fields of application

Digitalization of business has some main areas of application that should be highlighted (Manyika et al., 2011):

- Healthcare: in this fields are emerging different applications which are able to improve clinical decisions and analyze better the disease patterns, develop customized treatments, etc.
- Administrations and Public Sector: increasing of transparency, automatization of systems or development of innovative services.

- Retail: Analyzing the customer's behavior in stores, optimization in logistics and distribution, etc.
- Manufacturing: improved supply chain, better control of demand forecasting, applications via web, etc
- Personal location data: smart services based on personal geolocation, routing optimization, etc.

Of particular interest is the development in manufacturing, where is emerging a new concept called "Industry 4.0". Monitoring systems are advancing swiftly in the field of manufacturing. Thus, some academics are starting to speak about the advent of the fourth industrial revolution. Smart systems are able to minimize downtime of machines. On the other hand, accurate forecasting support management system to optimize manufacturing as well as to achieve a better safety management and maintenance of the machines involved in manufacturing process (Brettel, Friederichsen, Keller, & Rosenberg, 2014; Lee et al., 2014).

Information flows generated through the production lines allow chain a more orderly and transparent supply chain. All this has a positive effect on reducing costs (in energy, repairs, labor force) and in creating safer and more efficient work environments (Jazdi, 2014).

As conclusion, we can say that innovation capacity for innovation must be an inherent element inherent firms, and technological innovations emerge as the current great enabler to develop innovation processes (Bettencourt, 2010).

5.6 BARRIERS IN VALUE CREATION FROM DIGITIZATION

Although we have analyzed the applications and benefits of digitization for businesses and new value creation, there are still significant barriers to the success of these strategies.

Many of technologies and processes described are still in an early stage and sometimes these technologies are so new that it is too risky to embark on its implementation without sufficient empirical data to ensure success (Loebbecke & Picot, 2015).

When speaking of the barriers to value creation from adopting digitization models there were clear references to a growing emerging network perspective: There was clear recognition of the interconnectedness these innovations create and the resulting interdependence they create for creating business value. In some cases, an analysis from a network perspective in value creation from digitalization will be key (Schroeder & Galera-Zarco, 2016).

On the other hand, the cultural challenges that many companies face when digitizing their business are enormous. Another major concern is relating to privacy and data security, factors which need legislative and institutional impetus (Terzi, Terzi, & Sagiroglu, 2015). Despite this, the trend indicates that the use of new technologies positively affects the profitability of business, particularly thanks to one evidence: the decisions based on data obtained with these technologies will be more objectives and rational (McAfee, Brynjolfsson, Davenport, Patil, & Barton, 2012). In any way, it seems that we are at the point where companies that are investing in the use of big data and are able to combine it with their deep knowledge of its sector will be in a dominant position.

The development of the appropriate skills and an adequate training of personnel to analyze data and to get essential information from large volumes of data constitute important current barriers. Other barriers include the difficulty to design data analysis architectures in each productive sector. Likewise, the need for support of senior management and the lack of accurate business models are factors that determine the reluctances of some companies to take the path of business digitalization (Russom, 2011).

PART II

SERVITIZATION AND DIGITALIZATION IN

PROJECT BUSINESS

CHAPTER VI

**TOWARDS NEW MODELS OF VALUE CREATION IN
PROJECT BUSINESS**

6.1 INTRODUCTION

Research in value creation appears as one of the main research lines in project management, highlighting in particular the value creation beyond project delivery (Winter et al., 2006). This implies that project management should be associated with strategic management in thinking about new value creation (Normann, 2001). The objective is to understand the value creation in projects as a more complex concept encompassing different levels and phases (Lepak et al., 2007).

Project management should be elevated to a more strategic perspective and becoming part of global business objectives (Morris & Pinto, 2004; Shenhar & Dvir, 2004; Turner, 2014). In this context, creation of value starts to be understood as the subjective value that the customer (private client, organization or society) is able to perceive (Lepak et al., 2007).

Consequently, it seems clear that value conception in the field of project-based business is one of the key directions in the evolution of project management (Winter & Szczepanek, 2008). Managers need to start working with different perspectives of project management which are able to cope better with the increasing complexity of proper management and project itself, and not continue following the classical theories and models (Winter et al., 2006).

**6.2 THE NEW PERSPECTIVE OF VALUE CREATION IN PROJECT
BUSINESS**

As we have noted, it seems necessary to develop new theories, concepts and frameworks to help deal with the new perspectives of value

creation (Winter et al., 2006). This may lead to new management methods and different organizational designs replacing existing ones.

The strategic orientation in PBFs has been primarily focused on product / Project. So far, value generation was only linked with the development of the “product”, understanding “product” as the output of the project. By following this perspective, value was only create through the inclusion of improvements in Project outcomes by fulfilling required specifications, deadlines and budgetary limits. This value management was mainly aligned with the G-D logic we studied in the first chapter of this thesis (Atkinson, 1999)

However, lately we observe a growing stream in project business that consider value creation as the main strategic objective (Gebauer, Truffer, Binz, & Störmer, 2012). The focus now will not be in the Project itself (infrastructure, systems, goods, etc.) but in the business strategy of the Project. The main desired goal is to create value, to generate higher revenue streams and to achieve satisfaction of all stakeholders involved in the project (Winter & Szczepanek, 2008). This new trend requires the development of new fields of research, theoretical frameworks and concepts able to help professionals in the development of these new strategies for Project business.

The main research lines in need of development are those concerning strategic choice of projects, recognition of new forms of value, organizational changes involved, and especially, the proposal of new business models inspired by the new conception of value creation. Business models need to go away from traditional models inspired by the "value chain" in production (Winter et al., 2006).

Another feature of value creation in projects business is that sometimes is difficult to discern who receives the value. Around the project exists various individuals and organizations having different purposes. In other cases the projects are aimed at development of a community or society in general, making difficult to determine the creation and perception of value. Another complex issue affecting value perception in projects is the fact that value creation can

extend over long periods of time and is not corseted by the conceptual phases of beginning and project closure (Moss & Atre, 2003; Ogunlana, 2010).

6.3 HOW SERVITIZATION CAN TRANSFORM BUSINESS MODELS IN PBFs

Within the overall vision that we have defined, in which changes in the vision of value creation in the PBFs and Project management are observed, Servitization strategies acquires an important relevance. The introduction of services can transform the business model of the PBFs, or at least services can be integrated as an important part of their business (Galera-Zarco, Morales-Gallego, & Pérez-Aróstegui, 2014; Gann & Salter, 2000).

A new trend towards offering integrated solutions for projects is emerging. An initial appearance dates back to the 80s with the concept BOT (build-operation-transfer) (Grimsey & Lewis, 2002; Levy, 1996). These initial models give way to the concept of "integrated solutions" that will try to meet customer needs adding to Project outcomes different services throughout its life cycle.

(Brady, Davies, & Gann, 2005) in their research, believe that those PBFs trying to provide "integrated solutions" to its clients have to develop a range of capabilities which enable them to offer their customers: system integration, operating services, consulting services and financing.

In the next two chapters we will deep into the use of servitization strategies in PBFs through our research

6.4 THE ROLE OF NEW TECHNOLOGIES IN PROJECT BUSINESS

PBFs providing integrated solutions and with vocation towards creating value from the S-D perspective begin to show greater concern for the results expected by clients (Brady et al., 2005). This requires a thorough knowledge of customers' needs and expectations, and that is the point where new

technologies can acquire a very important role. Especially important is communication among stakeholders, technologies able to provide data from operation of a system or infrastructure or the use of visualization technologies (Cheng & Teizer, 2013)

The introduction of new technologies in projects is a sensitive process in which firms have to take into account implications that technology brings in the different phases of a project and the final result. Likewise companies must address the different natures of available technologies and also to understand and anticipate the impacts of technologies on different activities and the organization itself. Therefore it is essential to adapt business strategies to the technologies which firms decide to employ on the development of a project. (Linderoth & Pellegrino, 2005)

6.4.1 Monitoring architectures in project management

The topic of applying IT to better implement project management in PBF is not new. Of specific relevance are approaches to create mappings between the business and IT side of project management (Stantchev, Franke, & Discher, 2009). For this purpose the authors propose an approach called – the service-oriented architecture (Krallmann, Schröpfer, Stantchev, & Offermann, 2008). The approach was applied for the management of project landscapes using a portfolio-based approach in knowledge-based enterprises (Stantchev & Franke, 2009).

In order to build on and further extend these approaches to the specific objectives of the presented work the specifics of a monitoring architecture for such environments need to be considered. So, to gain an overview on well-developed monitoring architecture approaches, a literature review was conducted. The selected papers provide use-cases and developed systems to show their applicability. The main aspects of these approaches are briefly outlined as follow:

GridRM (Baker & Smith, 2002): the grid monitoring architecture (GMA) is based on the transmission of events, publications, and information. Within the very basic architecture, the specific publication and information bound to an event is provided by a directory service. The GMA directory service provides a webserver with a user interface and a gateway servlet to alert and information requests from remote gateways, serialize data objects, monitor local resources and store configuration and historic data.

OSPF Monitoring (Shaikh & Greenberg, 2004): the OSPF Monitor consists of three components with the aim to monitor Link State Advertisements (LSAs). While the LSA Reflector (LSAR) captures LSAs from the network, it sends the information to the LSA aggregator (LSAG) which performs the real-time analysis, as well as to the OSPFS can which is used for further analysis of the LSA archive. The authors explain that the separation of real-time monitoring to LSAR and LSAG benefits in the simplification of functions which results in an increased overall reliability. Moreover, they claim that the LSAR needs to be very simple since it has to reside close to the network.

Healthcare system Hierarchical Network Architecture in Wireless sensor networks (Huang, Hsieh, Chao, Hung, & Park, 2009b): while the authors focus on the security aspects of heterogeneous wireless networks, they provide a simple three-tier architecture for monitoring technology, which we will focus on the sensor network tier, we can find any kind of sensors, using ZigBee, Bluetooth, etc. These are transmitting data to ad-hoc network devices that create the mobile computing network tier. From these devices, aggregated and potentially consolidated data are send with GPRS, 3G, WIFI, or other protocols to local or remote routers that are connected to the internet, named as the back-end network tier.

PerfSONAR (Hanemann et al., 2005): The authors present a bundle of services that will be considered in the service layer of a proposed architecture for a multi-domain monitoring framework. The architecture consists of the measurement point layer which includes measurement points in different domains, a service layer where the services of the different domains interact,

and a user interface layer where the user is provided with data from the different domains. While this is a very basic approach, it can be used for every kind of monitoring technology. Main focus on the paper is the explained services: Lookup service, transformation service, authentication service, measurement point service, measurement archive service, and resource protector service.

MedSN (Kuryloski, Pai, Wicker, & Xue, 2007): the proposed architecture is matching with (Huang et al., 2009b), concerning sensor level, mobile gateway level, and back-end level. However, the authors focus on the requirements for developing such a system. Hence, it is explained which data types should be controlled by the sensors, based on interviews with target users. Moreover, the paper states that four principals should be considered while developing a system to take advantage of this architectural approach: minimizing data transmission, full consideration of security and privacy aspects, support of role models and their different interests, and contextual privacy for users and network data.

Indoor mobile asset management (Jeong, Jo, & Kang, 2014). The authors provide a fully-developed self-organizing software platform (SoSp) router that integrates multiple wireless protocols, different resource managers, software agents and even output services. Actually, this concept is not providing a monitoring architecture approach but the software architecture for the service level as also described in (Hanemann et al., 2005). While the presented SoSp router provides an all-in-one solution, it is incompatible with the OSPF Monitoring (Shaikh & Greenberg, 2004) proposal which explains the benefits of the components separation.

6.5 NETWORK PERSPECTIVE FOR CREATING VALUE IN PBFs

In many cases, a network perspective is also important in project management, especially when firms try to cover all the different stages of the project and to introduce advanced services. Sometimes a single company does not have the needed dynamic capabilities to offer complete management of new and complex services (Gomes, Donnelly, Morris, & Collis, 2007; Möller, 2010;

Möller & Svahn, 2009). Several times the investment to provide a comprehensive solution to the project is too high for a single firm. Therefore, to achieve certain goals companies have to become business network or try to create strategic partnerships in order to reach capabilities that a for a single company are more complex to achieve (Gebauer, Paiola, & Saccani, 2013; Gomes, 2010)

As we shall see in the next chapter, PBFs will seek the integration of all activities related to the life-cycle of a project in order to explode every possible value in a project and to develop new services. However, in practice such integration is very difficult to achieve, and that the solution of configuring business network becomes relevant. If companies are set in well-defined business networks (Angwin, Mellahi, Gomes, & Peter, 2014), they can explode and extract value from servitization and digitization. Solutions providers usually seek to develop long-term partnerships (Gebauer et al., 2012; Gummesson, Mele, Polese, Hakanen, & Jaakkola, 2012)

CHAPTER VII

SERVICE-ORIENTED BUSINESS MODELS IN PROJECT-BASED FIRMS: THE CASE OF ENERGY EFFICIENT ARCHITECTURE

ANTECEDENTS

Business models in Project business have traditionally been based on delivering value through the delivery of the output of the project. In the building sector, the customer perceives value only when receives the finished building, at which point it terminates its relationship with the firm.

New research strands on value in use and the employment of new business models lead us to propose the creation of new solutions that can include services as part of the firm's offering, increasing both the value perceived by the customer and the benefits obtained by integrating all phases of the business project, thereby achieving a lasting relationship with the customer.

In the context of energy-efficient buildings, technological innovation and its particularities of design, installations, maintenance and use arises as an ideal framework for studying the introduction of Servitization strategy into the business models of project-based firms (PBFs). In this Chapter, we attempt to evaluate how Servitization gains a leading role in existing business models in this area. We will propose a structure for new business models in this sector and, through case study, examine what kinds of models are emerging. We will then analyze these models and propose improvements for integrating services into all phases of the business.

7.1 INTRODUCTION

It is becoming increasingly clear that today, firms are undergoing a change in their supply chains (F. Bustinza et al., 2013; Wise & Baumgartner, 1999). This transformation occurs with the transition from a business model mainly grounded in the sale of products to new models based on offering integrated solutions in a combination of products and services (Neely, 2008). The creation of value by adding services to the product has been termed “servitization” (Vandermerwe & Rada, 1989).

To date, the literature on servitization has been focused primarily on the manufacturing sector (Baines, Lightfoot, & Smart, 2011; Clegg et al., 2013). However, we can find clear differences between manufacturing firms and PBFs. These include discontinuity of demand, complexity of offers, and individuality of the content and structure of each project (Cova, Ghauri, & Salle, 2002). As a consequence, the business model in PBFs have characteristics that make them different from business models in manufacturing industry and these particularities remain unresolved in the general literature on servitization (Arto, Wikström, Hellström, & Kujala, 2008).

Literature on Servitization contains descriptions of how manufacturing firms are transforming many aspects of their way of doing business. These transformations involve changes in strategy, value chain, customer relations and organizational structures. Firms are abandoning traditional ways of working and adapting their processes and structures to new servitization trend (Barnett, Parry, Saad, Newnes, & Goh, 2013; Brady et al., 2005; Gebauer, 2008; Parry et al., 2012). But such transitions are complex (F. Bustinza et al., 2013; Hobday, Davies, & Prencipe, 2005; Raja, Green, & Leiringer, 2010; Roy et al., 2009) and it would be wrong to think that the process of servitization could be adapted to other sectors simply by following the tendencies established by another kind of company and transferring solutions that work to other contexts. A gap exists in the literature on servitization in PBFs, and this research will attempt to contribute new knowledge of this area. The scholarly goal of this chapter is to develop a framework to describe servitization in PBFs. Specifically we attempt

to study how servitization affects business models that emerge in construction firms that build energy-efficient buildings.

A series of tendencies in the literature justifies and encourages performing this study. On the one hand, there is the growing implementation of servitization strategies in PBFs. These companies are currently seeking new entrepreneurial strategies that allow the satisfactory introduction of services into their business models. This change is altering the way firms obtain benefits, leading the firm to face new challenges in business design and organizational structure (Brady (Brady et al., 2005; Hobday et al., 2005). The Architecture sector is not exempt from the need to “re-evaluate” its business models (Barrett, 2005; Pearce, 2003)

On the other hand, it also observed a trend in consumers to take greater interest in the life cycle of their investments (Stremersch, Wuyts, & Frambach, 2001). This tendency leads to the emergence of a new kind of consumer, whose main interest in making an investment is not simply acquisition of the output of the project but its economic behavior during the use phase (Ivory, Thwaites, & Vaughan, 2003).

The complexity that the consumer perceives also plays a relevant role when providing additional services to the customer (Crespin-Mazet & Ghauri, 2007). As complexity increases, so does the probability that the consumer will become more involved (Sioukas, 1995). We base our focus, therefore, on the criteria presented regarding the tendency to servitization in PBFs, as well as on the need to redefine the business model in the construction sector. To achieve this goal, we add the presence of two factors which favor servitization in the sector of energy-efficient buildings—consumers’ increasing interest in the behavior of investments during the life cycle of products and the complexity stemming from technological innovation. The importance of creating knowledge about how firms in this new sector organize their business is widely justified.

This research attempts to respond to the following two research questions: How is servitization affecting the business models of PBFs in the area of

energy-efficient buildings? And, what new business models are emerging in this sector?

The rest of the chapter is organized as follows. First, we provide a literature review of research on servitization and business models. Secondly, the paper studies the main characteristics of project-based firms and energy-efficient buildings. Thirdly, we develop a framework for a servitized business model in this sector and relate it to the information derived from a single-case study. Finally, conclusions and future research lines from this new contribution are provided.

7.2 LITERATURE REVIEW

7.2.1 A theoretical review of Servitization

As we explained in chapter V, servitization is primarily customer oriented. The creation of value is understood through the eyes customers (Brady et al., 2005), changing the traditional view of value creation (Slywotzky, Morrison, & Andelman, 2007). Along these lines, Positional Advantage Theory argues that achieving positional advantage requires the appropriate response to customers' needs at a strategic level (Day & Wensley, 1988). This positioning is based on providing superior customer value. Service Dominant Logic also focuses on value generation, establishing that the customer acts as a co-creator of value and viewing goods as merely instruments for the delivery of services (Vargo & Lusch, 2004). In this context, service operations must focus on strategies to match customer expectations with customer perceptions (Armistead & Clark, 1993). Analyzing the value generated by services, value creation begins by providing value to the customer (Sirmon, Hitt, & Ireland, 2007). Value is not embedded in products but is instead realized in their use in a context where provision of value is created between firms and customers' participation (Grönroos, 2004).

Resource Advantage Theory also argues the importance of developing the relationships between firms and consumers (Sheth, Parvatiyar, & Sheth, 2000).

This theory derives from the Resource-Based View of the firm (RBV), which proposes that valuable resources are the drivers of value creation (Ireland, Hitt, & Sirmon, 2003). The value of a resource is based on the service it is able to convey (Penrose, 1959). The integration of services is a strategic tool that has been recognized as a source of sustainable competitive advantage (Cohen, Argrawal, & V.) .New services that are added generate distinctive and sustainable capabilities based on lower cost economies (Roy et al., 2009). For this reason, Servitization affects competitive strategy, increasing the value added and decreasing costs.

7.2.2 Business Models

The Business Model can be described simply as the way that a firm sets its business strategy in motion (Casadesus-Masanell & Ricart, 2007; Chesbrough & Rosenbloom, 2002). The literature provides many general definitions of Business model, many of which assume it represents the logical foundations of how the firm generates and captures value (Amit & Zott, 2001; Magretta, 2002; Osterwalder, Pigneur, & Tucci, 2005). Based on the definition of the concept, the existing literature has attempted to define the elements that constitute a business model and how these elements can be represented and classified (Demil & Lecocq, 2010; Osterwalder et al., 2005). Business models seek grounding in theories of business strategy, attempting to combine the different points of view on strategic management and its relationship to firm performance (Chesbrough & Rosenbloom, 2002; Hedman & Kalling, 2003; Morris, Schindehutte, & Allen, 2005).

The link between servitization and business models is based on early definitions of business models as the structure for the firm's product, services and information flows with description of the sources of value generation (Timmers, 1998). From this approach, we arrive at the definition of (Teece, 2010), who defines the essence of the business model as the way in which the enterprise delivers value propositions, thereby attracting customers to pay for value. This combined customer orientation and analysis of product-service bundles is closely related to the servitization framework.

The concept of the business model draws on various theories (Morris et al., 2005). Starting from the idea of value chain (Porter & Millar, 1985) and strategic positioning (Porter, 1996), business models comprise the architectural configuration at an operational level, and vision, value creation, network and alliances at strategic level (Gomes, Barnes, & Mahmood, 2016; Gomes, Weber, Brown, & Tarba, 2011) . Since business models seek competitive advantage based on configuration of resources, the RBV of the firm (Penrose, 1959; Wernerfelt, 1984), the Knowledge-Based View (Grant, 1996) and the Theory of Dynamic Capabilities of the firm (Barrales-Molina, Bustinza, & Gutiérrez-Gutiérrez, 2013; Teece & Pisano, 1994) are applicable in this framework. Other theories that could support business model arguments are cooperative strategies (Dyer & Singh, 1998)(Dyer and Singh, 1998) and transaction cost economics (Coase, 1937; Williamson, 1991),among others.

7.2.3 Project Based Firms

Project-based firms are firms structured around the projects they carry out (Gann & Salter, 2000). This kind of business is developed in temporary organizations established to achieve a specific objective rather than through continuous manufacturing or service activities (Lundin & Söderholm, 1995; Packendorff, 1995). Projects provide a unique solution for the customer (Hobday, 2000), who typically is the party commissioning the project, defines the specifications and provides financial resources, since the customer is the main beneficiary of the final product (Turner, 2014).

Business performed through a project differs from other kinds of business, due mainly to the specific relationship to the context surrounding the project itself, time constraints, the specific characteristics of value creation, complexity, the degree of uncertainty, and the minimal possibility of normalization of processes (Hellström & Wikström, 2005). Management of projects is performed independently (Hobday, 2000), limited primarily by the contractual agreement with the customer (Turner, 2014). Projects are developed by multidisciplinary teams, with the participation of professionals from more diverse disciplines,

especially when complexity of the project is greater. Each project usually involves a large number of employees, suppliers and subcontracted firms. The contracts are for a specific length of time and are usually preceded by processes of pre-evaluation, negotiation and planning. They commonly include guarantee periods and service agreements once the project is delivered (Wikström, Artto, Kujala, & Söderlund, 2010).

The importance of Project Based Firmss justified; they contribute considerably to the GDP of the most advanced economies (Gann & Salter, 2000; Knight & Consulting, 2000). PBFs are found in a wide range of sectors: construction, software, industry, and even cultural and sports activities (Sydow, Lindkvist, & DeFillippi, 2004). Finally, we should point out that innovation in PBFs consists of the development of new or better solutions for current or potential customers, as well as the development of new technologies that can be used to solve customers' problems that are not resolved with existing technologies (Blindenbach-Driessen & Van Den Ende, 2006). This is the case in the sector for the construction of low-energy buildings, which emerged from the development of new technologies to solve the problem of buildings' excess energy consumption.

7.2.4 Energy-efficient buildings

The rapid growth in world-wide consumption is a problem that worries governments and citizens, due to the difficulties of supplying energy, the exhaustion of energy resources, and the strong impact of energy production on the environment. The total contribution of buildings (residential and non-residential) to the energy consumed is increasing constantly, reaching figures of 20% and 40% in developed countries and overtaking sectors that have traditionally consumed more energy, such as industry and transportation (Pérez-Lombard, Ortiz, & Pout, 2008). Growth in the population and in comfort levels, as well as increase in the time that we spend inside buildings, ensures that the tendency to increasing demand for energy will continue in the future (Pérez-Lombard et al., 2008).

In its prediction of international energy consumption, the USA Energy Information Administration (EIA, USA Department of Energy) includes predictions for the consumption of energy in buildings. The EIA foresees that the use of energy in this sector will grow by 34% in the next 20 years, an average rate of 1.5%. In undeveloped countries, the increase in the population, as well as the construction boom predicted, will create even more pronounced growth in energy demand, with an average rate of around 2.8% yearly

Based on the data and the importance of the problem, governments as well as supernational organizations and the scientific community have identified the need for energy efficiency in buildings and have initiated significant efforts in this direction (Sadineni, Madala, & Boehm, 2011). The concept of energy efficiency in buildings is related to the reduction of energy consumption to the minimum needed to achieve desirable environmental conditions (Omer, 2008). The energy consumed in a building is used fundamentally for heating, cooling and mechanical ventilation systems (Pacheco, Ordóñez, & Martínez, 2012). Buildings' energy efficiency can be improved by applying two kinds of strategy: active and passive. Improvements in heating, cooling and air conditioning (HVAC), electricity, lighting, etc. are classified as active strategies, while improvements made through location, orientation, construction elements and design are classified as passive strategies (Sadineni et al., 2011).

Energy efficiency applies to the whole building—from its envelope, which includes windows, insulation, foundations and roofing—to the lighting and air conditioning systems. It also applies to the ventilation, cooling and heating systems, which are automated. Finally, improvements may be to the ductwork and advanced technologies used (Yung, Lam, & Yu, 2013). Passive systems are the set of architectonic techniques that attribute special importance to the solar energy gain, taking advantage of the orientation of the façades and roofs as well as the use of architectonic materials and special enveloping (Audenaert, De Cleyn, & Vankerckhove, 2008). Based on construction standards such as North America's LEED (Leadership in Energy and Environmental Design) or the European PassivHaus, the goal of these certification criterias is to achieve perfect climatization through processes that control the airtightness, heat flow,

insulation, and natural and mechanical heat ventilation, as well as orientation, as mentioned above.

The specific case of the PassivHaus standard (Feist, Pfluger, Kaufmann, Schnieders, & Kah, 2007) is not only a set of architectonic procedures oriented to guaranteeing the proper HVAC of buildings but an a posteriori certification that these standards have been fulfilled in the buildings cited. This standard thus achieves a degree of supervision and feedback that are very interesting for considering the inclusion of specific services after execution of the building. It is worth pointing out that the conceptual phase of the design of a building is the best time at which to integrate all of the strategies geared to reducing energy consumption. Conceiving the best means in each case, from the initial phase of the project, reduces the costs of implementation as compared with conceiving and installing these elements after construction (Wang, Rivard, & Zmeureanu, 2006). This procedure indicates the value of attempting to obtain a business model that attributes great importance to the study and design stages.

All of these methods and systems oriented to low energy consumption provide an added value that benefits end users. Design based on energy-saving criteria reduces economic costs throughout the useful life of the construction, recovering the initial investment in a short period of time. Further, the emission of CO₂ into the atmosphere is reduced throughout building's life, benefitting society in general (Pacheco et al., 2012). Finally, we would point out a factor that favours the development of the sector: the effort by governments to generate rules that make decrease in energy consumption in buildings compulsory. In this context, European Directive 2010/31 EU is especially relevant, as it requires the member states to ensure by December 31, 2020 that all new buildings consume almost no energy and after December 31, 2018 that new buildings that are inhabited by or belong to public authorities consume almost no energy.

7.3 FRAMEWORK DEVELOPMENT

In what follows, we will draw on the relevant existing literature to propose a structure to support servitized business models for firms in the sector of buildings constructed with criteria of energy efficiency. We will then analyse the importance of servitization in the model proposed through a series of factors that measure the impact of services in the development of the new business model. It is, nevertheless, important to note that developing business models based on services within PBFs requires abandoning the idea that value centres exclusively on the project-delivery phase (Davies et al., 2006). The project should be understood as a process that includes phases before and after the construction process and the customer's reception of the building. It should find ways to add services to each of these phases, ensuring that the customer perceives value in each phase.

We start by classifying services into three different categories during the purchase process (Samli, Jacobs, & Wills, 1992):

- (1) Services prior to the purchase decision (pre-sale): services that stimulate the consumer to make the decision to buy.
- (2) Services directly related to the purchase: services that help the consumer to make use of the product.
- (3) Services after the decision to buy (post-sale): services that seek to maintain the customer's satisfaction with the product acquired and to solve post-sale problems with the product; and services associated with maintenance and inspection of the building.

Another similar classification involves pre-sale service, activities for implementation and long-term activities (Helander, 2004).

By adapting this classification to the Project business, project is analyzed as a solution to a complex problem, which includes the activities essential to the

development of the project with the related services that can be associated before, during and after delivery of the project. Thus, a firm that supplies projects should study carefully what services to include during the different phases of the life cycle of the solution it provides to the client (Artto et al., 2008)

Figure 7.1 illustrates a proposal for a business structure adapted to PBFs in the sector studied here. In the figure, we can see three different phases in the development of the project over time. Each phase proposes the basic associated services that can be provided in each phase, distinguishing three fundamental stages in the development of the project:

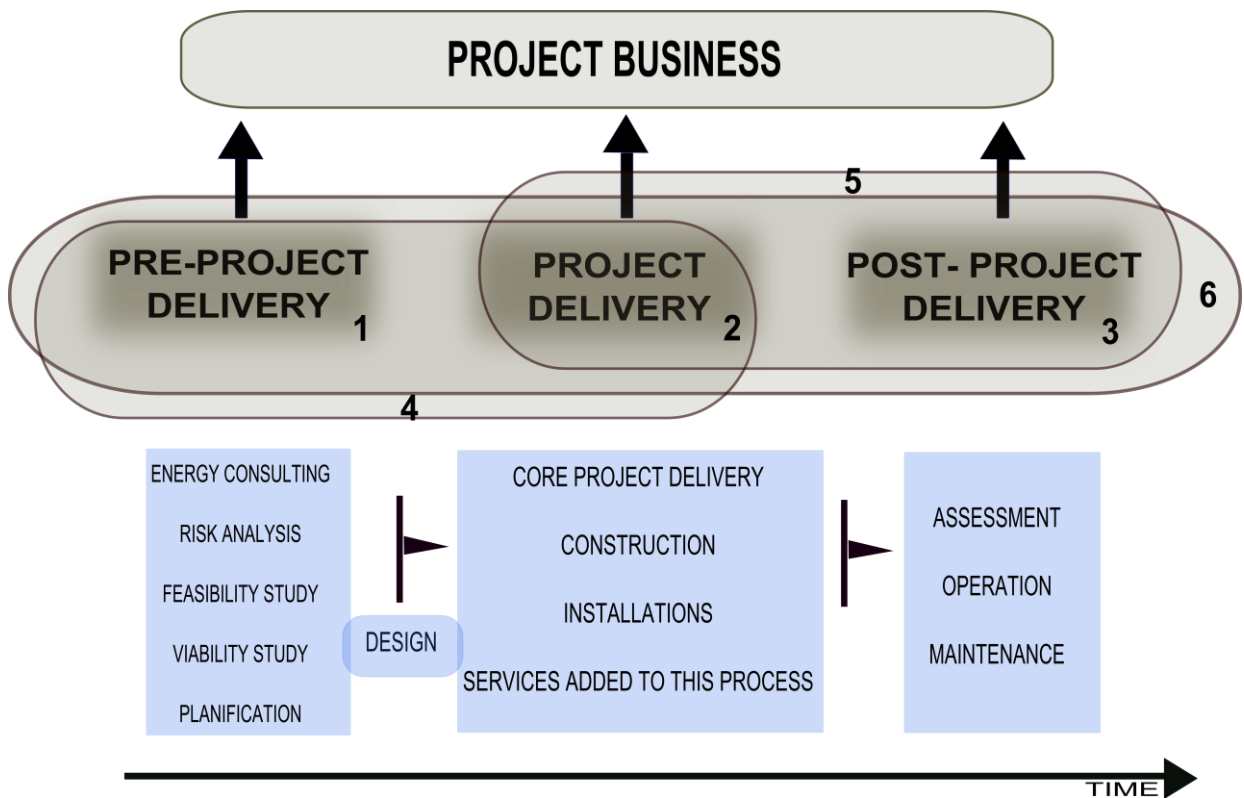


Figure 7.1: “Framework for servitized business models in Project Based Firms”. Source: Self-elaborated

- *Pre-project-delivery phase:* this is the first phase, prior to delivery of the Project. In this phase are included services involving the technical, commercial and economic viability of the project are developed (Ernst,

2002). A good technical and economic study of the project will contribute decisively to the project's success (Blindenbach-Driessen & Van Den Ende, 2006), as it will enable the definition of more realistic goals and provide a better determination of the behavior of the investment in the project (Cooper, 2001). We propose that this first phase include the services for planning and risk analysis, which will also contribute to establishing more precise deadlines.

Providing services in the pre-project phase will be important for the customer's conception of value. The more complete the initial study, and the more developed the reports on the energy savings and economic profitability of the investment, the more attractive the building will be to the client. The capacities that firms show in this pre-sale phase take on significant importance in the case of PBFs as compared to other firms. These capacities become decisive in obtaining the success of the project (Blindenbach-Driessen & Van Den Ende, 2006). Design can be included in this first phase, although it would developed after a phase to performance all of prior studies of technical and economic viability. An important characteristic of the design phase will be to involve the customer in the design, thereby attempting to co-create value. Design is the activity that connects directly to the project-delivery phase.

- *Project-delivery phase*: We first clarify that, in Project Management literature, the term project-delivery is used to indicate tangible goods (Kujala, Artto, Aaltonen, & Turkulainen, 2010). This is the phase that includes the essential activities of Project development: acquisition of materials, execution of construction, installations and some services added to the construction process itself, such as the preparation of reports on the evolution of the work and expenses incurred during its execution. This stage ends with delivery of the project to the customer.
- *Post-project-delivery phase*: PBFs currently tend to provide services beyond the project-delivery phase (Artto et al., 2008). The post-project-delivery phase thus includes all services that can be provided to the

customer once the building is delivered. Services of evaluation, operation and maintenance will be especially important, since they are services that provide the firm with an incoming flow of capital that will fluctuate less and will be more sustainable over time (Windahl, Andersson, Berggren, & Nehler, 2004). These services will also make possible to collect basic data on the functioning of the building. Subsequent analysis of these data will give the firm feedback in knowledge and information that have direct implications for future designs. Through management of the building, it will be possible to correct and improve designs and planning, increasing the efficiency of the project and the general process.

Another issue to stress in business models of PBFs is that firms have to adapt their business to the signed contract for each project (Tikkanen, Lamberg, Parvinen, & Kallunki, 2005). Some clients will only be interested in one of the phases of the project. Others will prefer mixed combinations of two phases, and yet others will seek to contract the entire process with the same company. PBFs must therefore adapt their business model to the customer's requirements in each project, combining or individualizing the different phases when necessary. This characteristic gives rise to different scenarios, in which the firm will develop its business model based on what the customer requests:

- (1) The pre-project-delivery, project-delivery and post-project-delivery phases are contracted separately with different firms. This is quite a common kind of contract in the construction sector (Leiringer & Bröchner, 2010).
- (2) The pre-project-delivery and project-delivery phases are contracted with the same firm but the post-project-delivery phase is contracted with another company. This is also a classic case, in which the same firm designs and builds.
- (3) The pre-project-delivery phase is contracted separately, but the other two phases are contracted together.

- (4) All phases are developed by the same firm. We understand this is the ideal situation, both for the company and for the customer, as it permits more intense development of the servitization process (Slack, 2005) and allows a longer-lasting, constant relationship with the customer.

Through the bibliographical review of services and empirical research with PBFs, (Artto et al., 2008) identified a series of factors in which to observe the impact of services within business models. Since these issues were proposed in the context of PBFs, we consider them useful for analyzing the characteristics of the business models for the case studied here. Through these impacts we can observe the degree of servitization of the model and can thus propose services adapted to the sector based on the type of effect. It can be identified six different types of impacts that describe how services influence the business of a PBF:

- Customer entry: refers to the desired effect of the service in encouraging the customer to enter into business, thereby also converting client into a potential customer of other services for the same Project or even for others projects in the future. In our case, this “call effect” can be achieved above all through services provided in the pre-project-delivery phase.
- Customer’s perception of value: understood as the effect of creating additional value for the customer through the service provided, which will clearly have a favorable effect on the profit margins and profitability of the supplier firm. Provision of associated services such as the profitability of the investment, energy evaluation, or management of maintenance and operations will increase the customer’s perception of value, making the product itself more attractive, profitable and easy to manage.

- **Competitive advantage:** refers to the increased competitiveness of the offer itself by providing the specific customer or market segment with more attractive elements than those offered by competitors. Through innovative services, the offer will be even harder to imitate, leading to sustainable development of competitive advantage. Competitive advantages with the model proposed can be obtained from any of the phases, insofar as services are offered that increase the attractiveness of acquiring the main product, (in this case the building). The greater the number of services provided and the greater their exclusiveness, the greater the competitive advantage that can be obtained.

- **Efficiency of delivery:** refers to the important influence of services in delivering a better-suited and more profitable product. For our activity, clients who hire services in the pre-project phases—services such as studies of profitability or viability, or prior design studies—will be able to obtain a final product that completely fulfils their expectations, both economic and technical.

- **Business of services:** where we understand that the service is justified as a profitable business, this involves creating a more stable and predictable source of income (Windahl et al., 2004). In our case, a more stable benefits stream which is less subject to abrupt changes in demand will derive fundamentally from services in the pre- and post-project-delivery phases. Specifically, energy consulting services in constructed buildings or typical services in the post-project phase, such as operations and maintenance, will provide incomes with less uncertainty and greater longevity.

- **Innovation and learning:** refers to the impact of services on the creation of new knowledge, new solutions and capabilities. This aspect improves not only specific and future projects but also the general procedures in the PBF. From the perspective of construction sector in general, and energy efficient buildings in particular, the greater the number of services associated with the construction of a building, the greater the knowledge

one can obtain of the product. Management of the full cycle, especially through operations, maintenance and evaluation, will enable the discovery mistakes in design, execution or operations.

The following table (Table 7.1) analyzes the factors cited above, showing the impact of the services associated with each factor and proposing the associated services corresponding to each factor for firms in the energy-efficient architecture.

Table 7.1: "The impact of services on business models for PBFs"

Impact Type	Impact on the business model	Services Proposed
Customer Entry	Services to encourage customer to enter into the business transaction, thereby also becoming a potential customer for other services and projects in the future	Energy consulting Free pre-designs Risk analysis Planning studies
Customer's Perception of Value	Associated services increase the consumer's perception of value and making the product itself more attractive, profitable and easy to manage.	Energy consulting Economic studies of profitability Full management of the project
Competitive Advantage	Competitive advantages with the proposed model can be obtained from any of the phases by offering services that increase the attractiveness of the main product. The greater the quantity and exclusiveness of the services offered, the more difficulty the competition will have in imitating them and the greater the possible competitive advantage.	Integration of all the phases of the project. Use of information from the post-project phase to improve the design and exploitation phases.

Impact Type	Impact on the business model	Services Proposed
Delivery efficiency	Services which are suited as closely as possible to the customer's expectation for the final product, in this case, the building	Design in collaboration with the customer Technical and economic planning suited to the interests of both parties
Services Business	Services as a source of own income. Services that have greater continuity over time and thus permit constant and predictable income.	Consulting Maintenance Operations Physical execution
Innovation and learning	Services associated with the building that permit increase in technical and operations knowledge, permitting the development of a process of continuous improvement in the business model.	Evaluation Operation of systems Maintenance Physical execution Integration of phases

Source: Self elaborated. Impacts types defined by Artto et al (2008)

7.4 RESEARCH METHODOLOGY

In this section, we will use the single-case study to understand in greater depth the entrepreneurial strategy and business model currently used in a firm from the energy-efficient architecture sector. We will analyze the characteristics of the business model used, situating them in our proposed framework. We will also observe the organizational adaptation of the firm to the servitization process. This analysis will give us closer and more realistic knowledge of the current development of servitization in companies from the studied sector.

Case study as research methodology can be defined as the empirical investigation of a phenomenon within its context (Yin, 2003). The case study has been shown to be a very good methodology for the development and verification of theories in different fields (Gibbert, Ruigrok, & Wicki, 2008), especially when quantitative research is not possible or appropriate (Yin, 2003). Although single case study has limitations for generalization of results, it remains a very effective tool when analyzing complex processes that are ongoing and providing information for the development of new theories (Eisenhardt, 1989). We chose case study methodology for this research because it provides us with greater contextual knowledge of a currently developing process (Stake, 1995; Yin, 2003), as is the case of Servitization in PBFs dedicated to energy-efficient buildings.

Therefore, the research was qualitative and we gathered information through a structured interview with senior managers from the company. The interview is considered to be a good source of information when performing an investigation through a case study (Yin, 2003). The company studied is ASOMA, a Spanish architecture firm that bases its projects on criteria of sustainability and respect for the environment. The questionnaire, adapted from (Mertens, 2012), is focused on analyzing the organization of the firm and the characteristics of the business model used, paying special attention to the factors that characterize the inclusion of services in this model. We established 9 blocks of questions that structured the interview—consumer, demand, offering, bids for projects, external organization, internal organization, contracts, income model and final results—resulting in a total of 41 questions.

7.5 FINDINGS AND DISCUSSION

We subsequently analyzed data from the interview and the additional information provided by the firm. In general, we can affirm that the firm studied is conscious of some of the advantages that the process of servitization can add to its business model. However, some evidences from the interview show that this firm has not yet developed completely the mechanisms and structures needed to achieve a fully servitized business model. The interviews confirmed a

strategic step toward customer focus and customer satisfaction, seeking to create more fruitful and lasting relationships (Saxon, 2002). Collaboration with the customer is sought, especially in the phase of definition and design of the project:

“Clients propose their needs and may of course give instructions on how they want the project features. In most cases, however, customers allow the experts to make proposals, so that they can obtain the best design possible based on technical criteria and value judgments. The firm manages to direct the customer toward what is most in this customer’s interest, although now customers come very well informed and know what they want. And they are right about their objectives in most cases. Our goal is to satisfy the customer, and if customers sometimes do not see clearly how to arrive at the objective, they understand in the end.”

Another noteworthy aspect is that the firm includes added services in its business model, following the proposed philosophy that focus on services must be relational and not transactional (Haroglu & Leiringer, 2010). In our case of study, services are provided especially in the pre-project-delivery phase, through the performance of technical and economic viability studies, as well as studies that predict the return on investment due to energy savings. However the firm does not provide new services to the customer during project execution, and also eliminates the post-project-delivery phase, considering the process finished once the building is delivered to the customer:

“Our firm provides a complex process of stages in defining the goal or commission that range from data recording, research, site study, and process, definition, and testing of the project to execution or construction as the final stage of the process.”

On the other hand, the company confirms the proposed advantages derived from providing a “full package” of goods, services, support and knowledge to the customer during the different project phases (Slack, 2005; Vandermerwe & Rada, 1989). At present, however, the firm does not consider

the post-project phase as an integral part of this package. It thus relinquishes the possibility of providing the construction and maintenance phases together (Lind & Borg, 2010) and of obtaining competitive advantages through the feedback process defined in our structure, even though the firm recognizes and evaluates this process positively:

“We provide the possibility of undertaking the full mission of the project, that is, all phases up to its completion. The advantages are guarantee and quality secured by the fact that we take responsibility for all of the phases, since this permits the proper execution of the project, ensuring the coherence and execution according to the design. This simplifies the processes and saves completion time because we perform the entire process.”

“We believe that by exploiting and maintaining the installations, we can obtain useful data that improve the design of future projects and contribute improvements that help for example to reduce energy expenditure.”

Regarding the internal organization needed to establish the process of Servitization (Hobday et al., 2005; Raja et al., 2010), we observe how the initial stage of the Servitization strategy requires to redesign the organization structure to seek a greater focus on services, for example, with the creation of a department of services and through improvements of internal communication between Area Managers in the different phases of the project (Leiringer & Bröchner, 2010). Through the questions related to bidding process, it can be observed the current inadequacy of this process to the phenomenon of Servitization. When the client chooses the company to do the work through a bidding process, services seem to have a little or no major role in that process. The contracts, however, seem to adapt to the new circumstances, providing the possibility of joint contracts that include all of the phases or individualized contracts for each phase. The income model is determined at the start of the project, divided into percentages throughout the project's development, but it is mainly based on execution works. In not considering the post-project phase, they diffuse the possibility of increasing the incomes and the influence on the

value chain through services provided in this last stage (Davies, Brady, & Hobday, 2007)

Answering the research questions

-How is servitization affecting the business models of PBFs in the area of energy-efficient architecture?

The sector of energy-efficient buildings is revealed to be a favorable field for the development of the process of servitization, and to transform business models adopted by PBFs belonging to this sector. The characteristics of this sector, particularly because of its technical innovation and the importance of obtaining profitability from initial investment, play a special role in encouraging Servitization strategies (Crespin-Mazet & Ghauri, 2007; Stremersch et al., 2001). This phenomenon has been observed in the growing inclusion of services in all phases of the project, especially in the pre-project-delivery phase, in which additional services can be added in the areas of energy, technical and economic consulting that do not apply to sectors other than PBFs. Likewise, operations and maintenance services become more significant due to the special characteristics of this sector, where life-cycle of the project play an important role to generate value and to recover initial investment. Thus, we can affirm that the process of servitization in PBFs specialized in energy-efficient buildings is beginning to be developed, although it is still in an initial stage and more results and information are needed.

-What new business models are emerging in this sector?

In the literature review, we find that PBFs are adopting increasingly servitized business models. They are abandoning the traditional idea of focusing the business on project delivery and execution process to extend its focus to the life cycle of the project (Helander & Möller, 2007) as can be observed by the growing tendency to add services in all phases of the project (Kujala et al., 2010). Different business models are thus currently emerging with greater attention to services. We have also showed that the business models of

PBFs are adapted to the needs of the customer in each project (Tikkanen et al., 2005), giving rise to diverse business models. These range from models that focus on one individual phase to those that provide complete management of the project (Leiringer & Bröchner, 2010). Through the case study, we analyze how the most adopted business models in this sector includes services in the pre-project phase but ends with delivery of the building. However, based on support from relevant literature, we propose the advantages of managing the full cycle of the project (Slack, 2005), with special focus to the post-project-delivery phase, which permits more stable income through more lasting services (Davies, 2004) and the possibility of implementing improvements in future projects through the data obtained from the evaluation, operation and maintenance. .

7.6 CONCLUSIONS AND IMPLICATIONS

In this chapter we have analyzed how servitized business models are emerging in PBFs, and within this sector, in energy-efficient architecture in particular. We have proposed a new structure adapted to PBFs, on which to ground the different business models that this kind of firm can adopt. In the structure, we distinguish three basic phases in the development of the project (Artto et al., 2008): pre-project-delivery, project-delivery and post-project-delivery. During each of the phases, we propose to servitize the business models through the inclusion of different services to encourage the development and exploitation of the project. With this model we also seek to create a more direct and lasting relationship with the customer (Kujala et al., 2010) to achieve a win-win situation in which the customer not only obtains a project fully adapted to his/her needs and aspirations but also obtains better knowledge about the project's future behavior, in both energy savings and investment.

Further, we identify a series of impacts of services within the business model (Artto et al., 2008). We have studied the impact of services on each of these factors for our case, identifying services that can be added corresponding to each impact factor. Knowing these impact factors is important to becoming

more aware of the influence of services in the business model of PBFs, which enables managers to develop new offers that attempt to improve the Servitization process and offer more attractive solutions to customers.

We also propose management of the “full package” as the ideal servitized business model for this sector and the model that can provide the best competitive advantages (Oliva & Kallenberg, 2003; Tukker & Van Halen, 2003; Windahl et al., 2004). Full management permits studying the project, involving the customer from the initial stages, and developing solutions together. By following this model, the customer is aware of the advantages and drawbacks in the decisions adopted (Brown & Eisenhardt, 1995; Ernst, 2002; Von Hippel, 1986). The construction process will clearly work better if it is performed by the same company that made the design and previous studies, a process that also enables better planning, avoids delays and provides technical and economic viability with less uncertainty (Blindenbach-Driessen & Van Den Ende, 2006; Cooper, 2001). If firms are able to engage customer to develop the three stages of the project (pre-project-delivery, project-delivery and post-project-delivery) the services related to managing the building during its life cycle will be enhanced by all of the prior knowledge collected from evaluation studies, design and execution (Bennett & Iossa, 2006; Martimort & Pouyet, 2008). This procedure enables greater profitability for the customer and less likelihood of problems derived from lack of information about previous stages.

After analyzing the structure developed, we propose that the management of evaluation, operation, maintenance and diagnostic services permits the firm to gather data on the functioning and profitability of the solutions adopted. This information becomes crucial for developing a feedback process within the firm to allow preliminary studies, designs and construction methods which could be increasingly better adapted to the problems that typically arise. The firm will be able to provide more effective solutions that ultimately favour the customer.

From the case study performed, we can deduce that firms in this sector should take the step to adopt business models that permit them to achieve the integrated management of projects. It is necessary to replace gradual changes

in operations and management with a paradigm change affecting the entire way of working to achieve Servitization (Barnett et al., 2013). PBFs must promote the capturing of customers more actively through different services (De Brentani & Ragot, 1996), even providing free consulting or technical and economic analyses at low cost. Firms should be also more aware of the importance of the post-project-delivery phase, since this phase will enable them to exploit the services during the life cycle of the project providing them lasting income stream (Davies, 2004).

Finally, through the real case study, we see that public administrations, as bidders on large projects, should be aware of the phenomenon of servitization, and must include factors in the bidding process which consider the importance of supplying services and full management for a project. The main limitations of this study derive from the use of a single case study methodology, which does not permit us to generalize the conclusions obtained from it (Eisenhardt, 1989). We recommend performing a case study with a larger number of firms with different business volumes and different international markets to be able to generalize conclusions and evaluate the accuracy of the proposals developed.

As future lines of research, we propose more in-depth study of the competitive advantages involved in the process of obtaining feedback from services during operation, analyzing more thoroughly this process and its effects on the firm's business model and organizational structure. It is also necessary to perform further studies of services associated with each phase of a project. Another possible line of research would be to develop a better analysis of how PBFs can improve their organizational structures to adopt more accurately the process of Servitization.

CHAPTER VIII

**SERVITIZATION AND DIGITALIZATION IN
ENGINEERING COMPANIES**

ANTECEDENTS

We have been observing how Servitization strategy is becoming increasingly important within business model structure in PBFs. These companies are seeking to complement their offering with the addition of services associated with the project. The main objective of Chapter is to contribute and increase the knowledge about implementation of this business strategy within engineering companies, paying especial attention to the use of smart technologies. To achieve this goal we will study the case of civil engineering companies and we will focus primarily on two main issues: first, to determine factors that may favour a successful adoption of servitisation strategy in engineering companies. Secondly we will analyze the use of digitalization to configure services which can be included during the different project phases. We also study how the feedback process derived from analysing digital information during the project, positively affects subsequent development of future projects and the creation of new and improved services. The ultimate achievement will be to find competitive advantages that engineering companies obtain through this strategy.

8.1 INTRODUCTION

Today, there is a widespread trend across all industry sectors in the search for differentiation and competitive advantages by employing servitization (Vandermerwe & Rada, 1989) and different strategies derived from the conception of value in use (Vargo & Lusch, 2004).

As is being noted in manufacturing business (Baines et al., 2016b; Clegg et al., 2013; Wilkinson et al., 2009), the incorporation of services to the business model also happens with a greater impetus in companies that base their activity on projects (Kujala et al., 2010). The inclusion of services in engineering firms is not limited to the provision of additional services to the project, but it is also based on the offering of solutions that optimize control systems, operation, repair and maintenance (Ivory et al., 2003). These solutions, aimed at increasing the life-cycle of delivered projects, allow companies to maximize the benefit by capturing a greater portion of the overall value.

There are several arguments that encourage facing the process of servitisation for these kind of companies: Economic factors: since services offer higher profit margin and can provide significant income, especially when the life of delivered project is long. Client satisfaction: because more informed and connected clients increasingly have higher demands (requirements) levels that can be satisfied through services (Bustinza et al., 2015). Obtaining competitive advantages: considering that services are more complicated to imitate and implement (Motwani, Sower, Gebauer, Friedli, & Fleisch, 2006) and that the offering of additional services to a project makes more exclusive the company proposal. (Figure 8.1)

These new servitized proposals are being specially favored by technological innovations and digitalization phenomenon (Grubic, 2014), especially by those advances that enable monitoring and data collection from projects. However, research on the use of digitalization for servitization strategy is still in its early stage. So an effort is needed to increase knowledge in this

area, given the great potential of smart technologies to develop advanced services and generate innovative business models in the engineering sector.

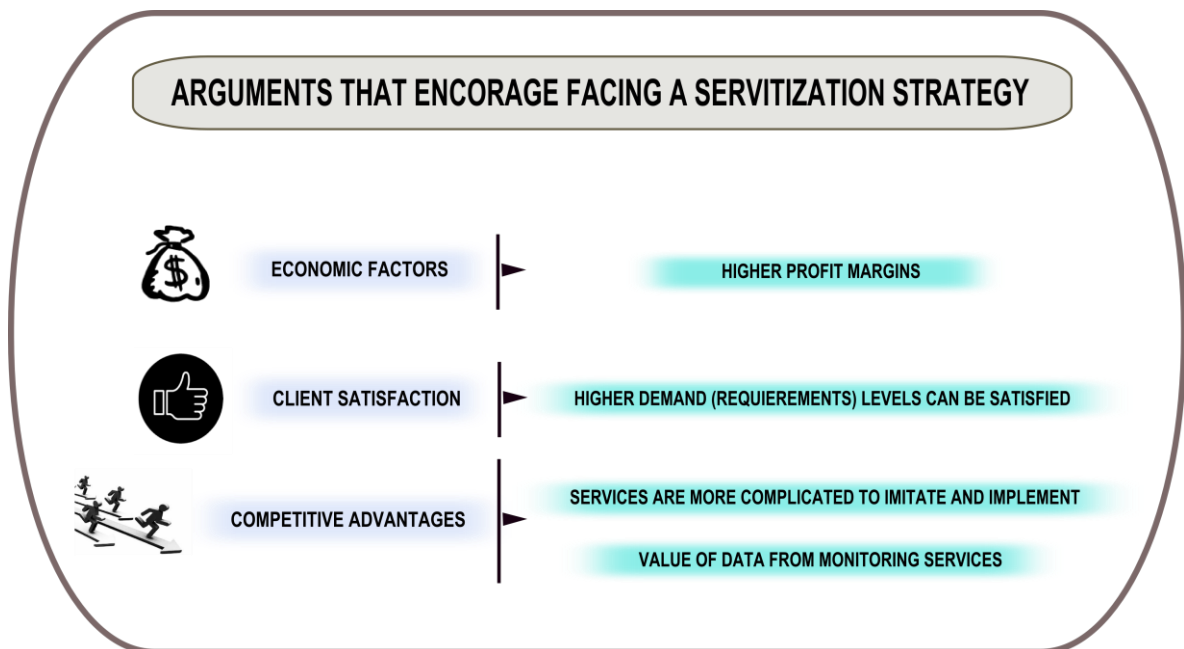


Figure 8.1: Factors encouraging Servitization strategies in PBFs. Source: Self-elaborated

The main objective of this chapter will be to increase the knowledge on implementation of servitization and digitalization for project based firms. We will try to achieve this goal by accomplishing two essential points: to study the functionality of innovative applications for addition of services in the business model of civil engineering companies and suggesting competitive advantages associated with these new services.

8.2 LITERATURE REVIEW

8.2.1 Servitization & Engineering companies

Project-based firms (PBFs) are defined as those whose primary activity is carried out through temporary organizations that aim to develop a project (Wikström et al., 2009). These companies have characteristics that differ from other companies because of the different ways in delivering value, the degree of uncertainty, the close relationship with the context in which the project is

developed and the low possibility of standardization (Mutka & Aaltonen, 2013). For all these reasons, its business models require a particular study.

On the other hand, the role that services play on the business models of PBFs is shifting. The importance of services is increasingly growing (Figure 8.2) and a continued evolution towards servitized business strategies is being observed (Galera-Zarco et al. 2014).

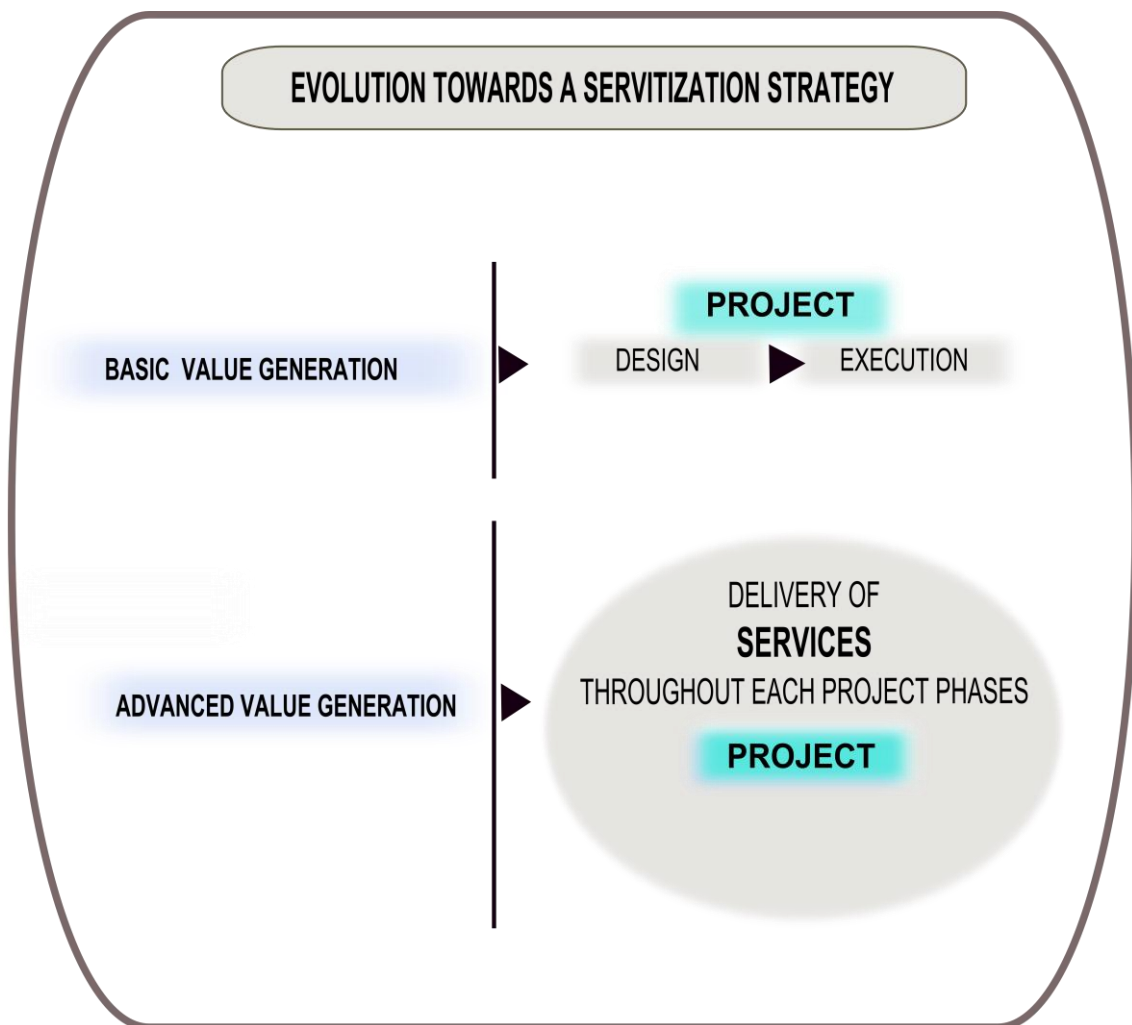


Figure 8.2: " Evolution towards Servitization Strategy in Engineering Companies" Source: Self-elaborated

Currently engineering companies seek to complement their traditional offering with the addition of services and delivering comprehensive client solutions ranging from design, testing, setting up, maintenance and optimization

during the life cycle (Kujala, Ahola, & Huikuri, 2013). That is, PBFs try to adapt their projects to cover all the specific needs of their client through the incorporation of services associated with the development of the project (Kujala et al., 2011). Services can be introduced in the project through different delivery channels: delivery of subproject, delivering complete subsystems, consulting, supervision, turnkey deliveries, operation services, etc. (Brady et al., 2005)

Furthermore, it should be noted that clients are increasingly interested in the behavior of their long-term investments (Stremersch et al., 2001). This fact encourages the inclusion of services which favor cost optimization over the life-cycle of the output of the project. The inclusion of services to improve the operation and functionality of the delivered project during its life-cycle can be a source of competitive advantages (Kujala et al., 2013; Xiang & Rongqun, 2006).

Today, the high competitiveness between PBFs makes them seek innovation and the creation of sophisticated projects and new models of project management that compete not only on economic value (Laurson & Svejvig, 2015; Morris, 2013; Ortín-Ángel & Vendrell-Herrero, 2014). In this context, Servitization and digitalization become increasingly important strategies in the search for a constant contact with the client. Innovation plays a key role in the introduction of services, hence the importance of the incursion of new technologies to develop new and better services.

8.2.2 Digitalization in engineering companies

Smart technologies are recognized as an important enabler in servitization strategies and an incentive for innovation in services (Baines et al., 2011; Grubic, 2014; Roy et al., 2009). However, still there is little literature on their contribution, potential and future challenges as a tool for servitisation strategy.

Monitoring technology can be defined as a combination of hardware (infrastructure, wireless technology, sensors, etc.) and software (transmission

technologies, algorithms technologies, data acquisition, etc.) that allows remote data collection about components and processes to determine their performance and predict their condition and state (Grubic, 2014).

Among the contributions of the Smart technologies in projects, a reactive and a proactive use of them can be observed. Reactive because of the minimization of inactivity time thanks to a greater speed in detecting and troubleshooting. Proactive use because they can prevent failures before they occur (Cheng & Teizer, 2013). Therefore, smart technologies enable to make more attractive offers to the clients.

According to the reviewed literature there are some benefits for companies supplying services based on new technologies: improvement of the design and the performance of projects, improvement of operational efficiency, cost reduction, differentiation from competitors, better understanding of client needs and information about operation that helps to improve R & D (Grubic, 2014; Schwalbe, 2015).

Finally, a significant growth is observed in the literature on innovative concepts like internet of things or smart objects (Miorandi et al., 2012) that will become familiar to us in the near future. These new concepts present technologies that will be able to supply real-time information even in highly dynamic environments such as a construction site. The internet of things will allow us to transform any element present in a construction site (from construction machinery to a beam) on an intelligent object by integration of sensors and connectivity technology (Kortuem et al., 2010). Materials and different structural elements will be able to supply data about its behavior, emerging smart infrastructures. Internet of Things will enable, among many other things, early detection of structural pathologies, real-time measurement of corrosion, settlements and deformations or a smart management of traffic, water and electrical networks (Djahel et al., 2015; Kitchin, 2014).

8.3 ENABLERS FOR SERVITIZATION STRATEGY IN THE ENGINEERING SECTOR

Services in the engineering sector begin to be seen as a key element of business models for potentiating the offers that are made to the clients (Arias Aranda, 2003). This trend towards greater service orientation requires a more detailed analysis of the different contexts surrounding both engineering companies and the projects themselves (Wikström et al., 2010; Wikström et al., 2009). The object of this analysis will be to identify factors that can potentially encourage the inclusion of services in this type of business.

Taking into account all of the above and according to a deep review of the relevant literature, we identified several factors that play a key role for the introduction of services within business models in civil engineering companies (Table 8.1).

ENABLERS FOR SERVITIZATION STRATEGY IN ENGINEERING COMPANIES	
COMPLEXITY	<ul style="list-style-type: none">• Design• Execution• Operation• Maintenance• High Quantity of sub-systems and components• Variety of skills and engineering outputs• Variety of distinct knowledge bases• Feedback loops from later to earlier stages• Quantity of alternative component design paths

ENABLERS FOR SERVITIZATION STRATEGY IN ENGINEERING COMPANIES	
CUSTOMIZATION	<ul style="list-style-type: none"> • High possibilities of co-creation activities • Degree of customisation of components • Degree of customisation of project itself
DURATION OF THE PROJECT	<ul style="list-style-type: none"> • Long term
LIFE SPAN	<ul style="list-style-type: none"> • Long term
CLIENT	<ul style="list-style-type: none"> • Trusting and strong relationship with the client • Credibility of the client • Ability to respond to client's expectations • Intensity of user involvement
INNOVATION	<ul style="list-style-type: none"> • Degree of technological novelties • Ability for supplying Smart technologies • Extent of embedded software in the project • Ability to innovate with process and equipment • Visibility of technological innovations
RISKS	<ul style="list-style-type: none"> • Medium-high risks in design, execution, operation and maintenance • Ability to identify and manage risks • Ability to manage risks
SUPPLIER	<ul style="list-style-type: none"> • Strong relationship with their own suppliers
CONTRACT	<ul style="list-style-type: none"> • Flexibility • Enough duration • Availability of finance from third parties

Table 8.1: "Enablers for servitization strategy in engineering companies"

Source: Self -elaborated

- *Complexity*: (Crespin-Mazet & Ghauri, 2007) state that customers are more likely to demand services when complexity of the project is high. (Guillou, Crespin-Mazet, & Salle, 2003) and (Sioukas, 1995) support that the perceived complexity by the customer is key when choosing contracts in which the services are in the limelight. Customer trends to become more involved with the project also increases with the perceived complexity.

Therefore, complexity is considered one of the key factors that facilitate the inclusion of services within the business model in PBFs. The complexity of the project can be manifested in its different phases: design, implementation, operation and maintenance. Some of the elements that help us understand this general concept of complexity are: the number of sub-systems and components, the skills necessary for their development, the breadth of knowledge required by the Project, feedback loops from later to earlier stages and quantity of alternative component design paths (Hobday, 1998; Pitsis, Sankaran, Gudergan, & Clegg, 2014).

- *Customization*: The degree of customization in components, systems as well as in the various activities taking place in a project as well as the co-creation possibilities in this factors can be seen as an enabler for servitization strategies in engineering companies (Turunen & Neely, 2012).

- *Innovation*: The ability to innovate by the company and the ability to manage innovation within the organization itself (Baines & Lightfoot, 2013b). Other factors are: The possibilities of technological innovation within the project and the visibility of these innovations by the customer (Salunke, Weerawardena, & McColl-Kennedy, 2013).

- *Risks*: The presence of risks in the project is another factor that promotes the inclusion of services, since the servitization involves a transfer of risk from the customer to the company (Jaska, Reyes, Laine, Paranko, & Suomala, 2010). The ability to manage risks by the PBFs also plays an important role.

Safety in the proper functioning of the delivered project is also a concern for the customer. This allows the creation of regular review and monitoring programs to predict the need of spare parts or repairs before failure or breakage occurs (Ward & Graves, 2007).

- *Client*: Different aspects related to the client may be important to promote the inclusion of services: customer confidence in the organization, both technically and economically (Baines & Lightfoot, 2013b), ability to respond to client's expectations and ability to include customer in value generation (Grönroos, 2011a).

- *Supplier*: There must be mutual trust between suppliers and PBFs. The intensity of this relationship has direct impact on the ability of servitizing in projects (Baines et al., 2016b; Schroeder & Galera-Zarco, 2016).

- *Contract*: The capacity to establish contracts away from excessive complexity, in which the client observe low risk of breach (Baines & Lightfoot, 2013b). Long-term contracts and articulated by flexible clauses seem to favor servitization strategy (Robinson, Chan, & Lau, 2016)..

Long term for the duration of the Project and Life Span is a key factor as enabler. The servitization is a particularly appropriate strategy when physical assets have a long life, since associated services will be required for years (Daniel Kindström et al., 2014).

8.4 SERVITIZATION AND SMART SERVICES IN CIVIL ENGINEERING COMPANIES: A BUSINESS MODEL DEVELOPMENT

In this section we will focus on the civil engineering sector to develop taxonomy of new services derived from the process of digitalization in companies of this industry. Through this taxonomy we propose a theoretical framework to implement strategies sustained in the new conception of value creation in project based firms and project management.

As first step, we propose that during all the project phases, civil engineering companies should be attentive to the wishes of the client, and for that, implementing a service-based strategy to increase communication and information technology between company and client may be essential.

The information technology acts as an enabler for new services based on innovation. The development of smart technologies can achieve the total satisfaction of new needs expressed by clients and public administrations, enabling engineering companies offer better services and solutions.

Now, we will develop a model that proposes different services based on smart technologies that can be included during different phases of the project (Figure 8.3) Through this model and relative examples we will also see how this strategy can lead to competitive advantages.

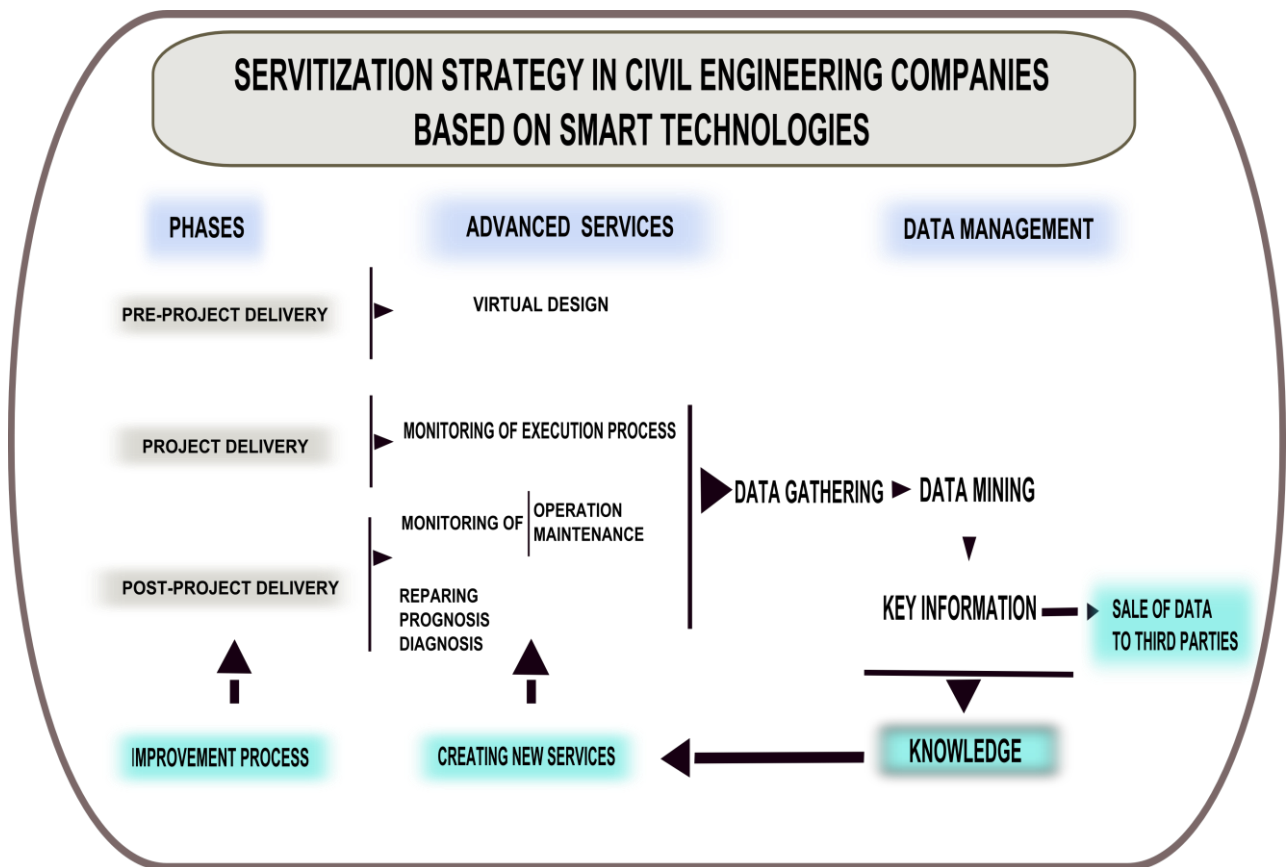


Figure 8.3: “Servitization strategy in engineering companies based on smart technologies”

Source: Self-elaborated

- Pre Project delivery phase

During these phase different services based in use of new technological tools are proposed as part of servitization strategy in this kind of companies:

Virtual design: the use of new tools for virtual design is able to provide the client very realistic visions of the different phases of the project and final results. The clients can even make proposition for the design through these applications, establishing a co-creation process. These types of services are able to show to the client the different solutions for the project. So, the client could observe easily the effectiveness of different proposals and how would be the final result. With this kind of services, both companies and clients have a better knowledge about the difficulties that are assumed in the development of the project and the financial and technical risks inherent to it. Furthermore deviations between created expectations by the client and the actual outcome will be avoided.

This is for example the philosophy of BIM (Building information modelling). A BIM model is a virtual equivalent of all construction elements used to construct a building or civil work (Azhar, 2011). The digital prototype has all the characteristics (physical and logical) of the real project. It allows us to simulate and understand its behavior before actual construction begins.

Nowadays, we can also find software on the market able to offer a comprehensive virtual analysis for the design of civil works. An example is Power Civil, developed by Bentley ®. This software allows visualizing virtually the development of the project. We can discover critical points that help us to improve the planning phase. In the case of linear works, virtual itineraries are generated, helping to reduce the visual impact. It is also possible to export data directly from the software for the automatic guidance of construction machinery.

In the same developing line, AECOM ® has developed a tool that during the design phase can determine the energy behavior of a building or infrastructure.

The SSIMe tool (Sustainable Systems Integration Model. Energy module) determines energy conservation measures (ECMs) that could be taken to improve its energy efficiency. ECMs are evaluated by the SSIMe process, especially HVAC systems, lighting systems and renewable energy solutions. So, it is possible to assess the energy savings to be gained and to develop an energy program associated with the life cycle. These virtual design tools have been already used in some projects as San Ysidro Land Port (USA) or NASA's Ames campus in Moffett Field (USA).

Project's monitoring study: developing a study during the pre-project delivery phase about how to monitor the civil work will be a key to control its operation and to introduce better services on diagnosis, repair and maintenance. The development of a sub-project of monitoring is proposed as a useful associated service. That is, the civil work would be studied from the perspective of which critical elements, structures or systems should be monitored with the objective of adding value to the final project. During this study an intensive collaboration with the client is also sought in order to co-create value for the project (Aarikka-Stenroos & Jaakkola, 2012).

In this sub-project, it is proposed an analysis about which dimensions (wear, deformation, settlement, etc.) and elements should be measured and which not. This service also provides what kind of sensors and technology is applicable, how to perform the embedding of different sensors in the elements, which type of data will be obtained and how to manage and analyze these data. The philosophy of this service is that from the time an infrastructure is being designed, it should be conceived how to monitor its execution and future operation.

- Project delivery phase

Monitoring of the execution process: it is well known that during the execution of a project the amount of information and documentation generated is enormous. Accurate information about the progress of the implementation of the project is an important factor for all actors involved in it. The multiparty structure of a

project causes that its success largely responds to the adequate transfer of information between all involved stakeholders: managers, contractors, designers, etc.

However, at present, the client is often left out of access to real time information of a project. And this happens despite being important information for him. Delivery delays, problems in certain phases of the project or even climatic uncertainties causes changes on the initial planning that can generate diverse problems for the client (in planning, finance, etc.). Hence the importance of starting to share information in real time with the clients, helping to involve them in decision making and providing information about the actual status of the project at any time.

To implement this service, there are different models for the collection, organization and sharing of the information generated during the execution of a project. There is also software that allows real-time dialogue between parties involved in a project. The novelty would be to include clients in this software giving them access to information that they demand or contract. It could be developed through a cloud-computing infrastructure able to storage actual reports and daily updates on the progress of the works, costs, etc. There are various software and applications that enhance communications and allow sharing information about project management: Basecamp, Trello, Blimp, Asana, Ganttproject or Redbooth. Most of them are cloud-based and could provide this kind of service for the client during the execution phase.

This service can be seen as a very positive factor for the client and as a competitive advantage for the company. Clients and public administrations should seek companies that offer this service of real-time monitoring because poor coordination and inaccurate, delayed or insufficient information are serious and very common problems for client during project execution (Kerzner, 2013).

On the other hand, during the execution of the project, the monitoring of particularly complex tasks arises as an interesting added service. For example, the monitoring of singular structures allows to verify in real time calculation

hypotheses or to adopt changes in the execution phase if necessary. An example of the use of this kind of technology is being carried out by a team of engineers from Centre for Smart Infrastructure and Construction (CSIC) at the Cambridge University. During the construction of Crossrail in London (UK), they are studying for the first time the incidence of excavation in nearby structures in real time by using sensors and information systems. In particular, they are employing new sensing technologies to monitor a 30 metres stretch of Royal Mail tunnel beneath Liverpool Street Station, this stretch is located only a few metres above the excavation of one of Crossrail's new stations. Three technologies are being used in parallel: optical fibre to measure efforts, long-life and low power consumption wireless sensors for recording movements, vibrations, humidity and temperature; and photogrammetry techniques that through a computerized display system allows to reconstruct the shape and position of an object from photographs. These technologies are able to provide massive amounts of information, very useful to understand the ageing of an infrastructure, and how best to maintain and protect it.

- Post Project delivery phase

During post project delivery phase our servitised strategy proposes services that include monitoring of all components able to supply data about operation and maintenance of an infrastructure. The client will have a need of information that should be satisfied, especially with regard to the operation, maintenance, diagnosis and repairs of the project delivered.

During this project stage, it would be important to offer services able to provide real-time information. Through this monitoring process, different services can be offered: performance optimization, preventive maintenance, diagnosis, spare part service, facilitating services, etc. (Kujala et al., 2013).

One example of this kind of services can be observed through the participation of INDRA® in Panama Canal Expansion project. This company is implementing different technologies in order to offer several services for operation and maintenance of the infrastructure. Some of these services are:

integrated control of access and security, vessel detection system, traffic control, lock-gates control, fire detection and evacuation systems and a net of environmental sensors to control the third set of the Panama Canal Locks.

These services based on the use of new technologies try to add intelligence to infrastructure and make it more efficient as well as ecologically and economically sustainable. These intelligent technologies provide real-time information for decision-making and can offer added value, increasing the levels of safety, efficiency and respect for the environment.

Basic monitoring architecture

In order to deep into the technology needed for the implementation of these services, we propose the following diagram. This represents complete integration of all literature about monitoring architecture explained. Basically, this diagram shows how the devices are integrating the services and a simple example how services are interacting.

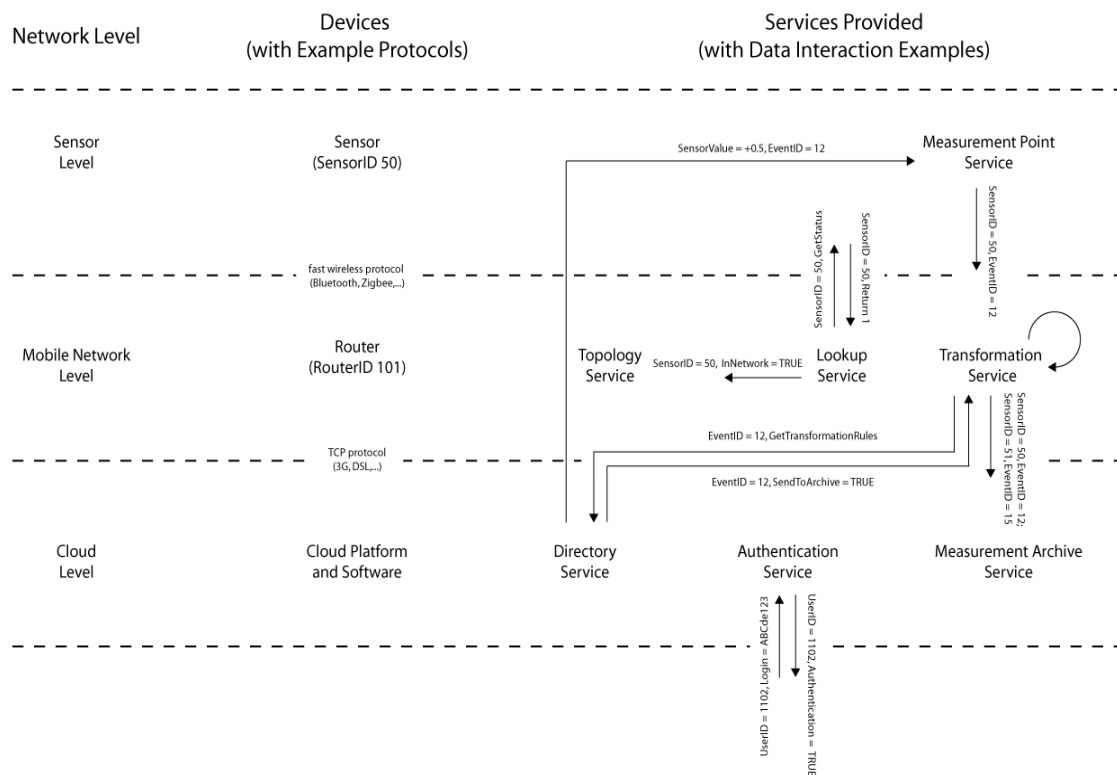


Figure 8.4: Diagram of monitoring architecture. Source: self-elaborated

8.5 GETTING INFORMATION. THE IMPORTANCE OF DATA MANAGEMENT

Monitoring activities generates a remarkable quantity of data. An accurate use of these data is able to create new services based on the new knowledge derived from data mining. This use of data opens new markets and creates new value propositions for clients in civil works (Opresnik & Taisch, 2015).

First of all, we must be aware that data analysis allows discover patterns about the behavior of infrastructures and it should help us identify potential and most usual failures linked to these patterns. It means that data collection connects the infrastructure behavior with its design, construction process and its surrounding environment. So that, the generated information makes possible to learn from the actual behavior of an infrastructure in a given context and extrapolate the results to projects which will be developed in similar contexts.

The process of implementing information gathering would follow this model (Opresnik, Hirsch, Zanetti, & Taisch, 2013):

- 1) Creation of Smart items or installation of sensors in essential elements of the infrastructure.
- 2) Implementation of technological applications that allow data collection and storage.
- 3) Conduct a thorough analysis of the data in accordance with the objectives set by the developer of the project.

The use of the servitization strategy with the help of data gathering enables companies to obtain potential competitive advantages by:

- 1) Improvements in the design, implementation, execution, operation and maintenance of a civil work as a consequence of an objective and

realistic knowledge about all processes around the construction and operation of the infrastructure.

- 2) Create new services from knowledge obtained through data management that could be useful for the client. For example: traffic control services or maintenance services based on structural health monitoring (Figure 8.5)
- 3) Sale of data on behavioral patterns of infrastructure itself and users to third parties who are interested because they will undertake similar projects.

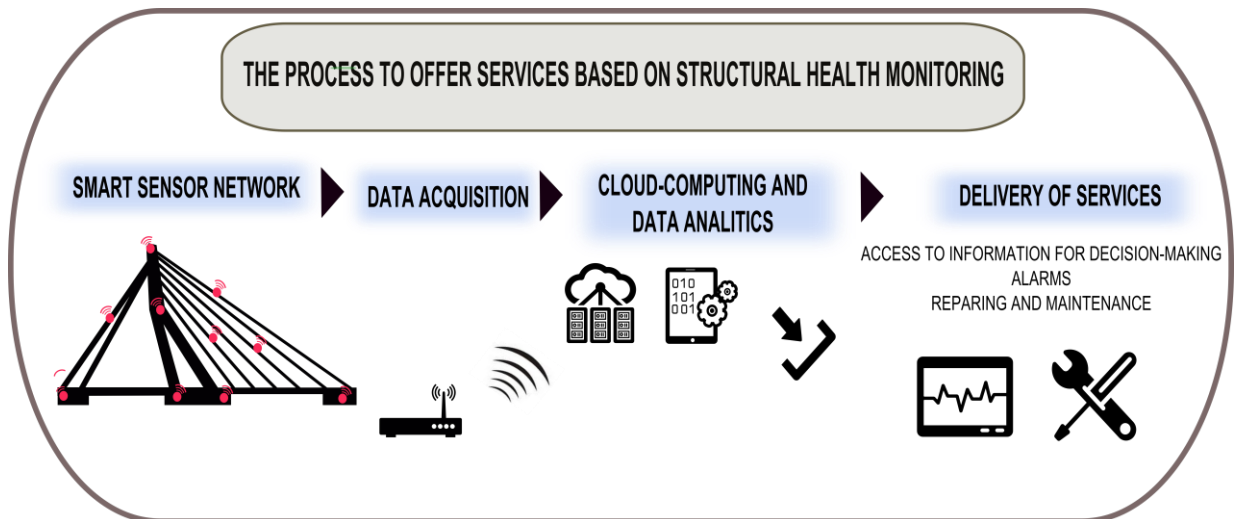


Figure 8.5: "The process to offer Services based on Structural health Monitoring". Source: self-elaborated

Finally it should be emphasized how data management facilitates a feedback process that affects all phases of the project. Data collection will vary depending on the operation and the environment in which the project operates. This will detect problems and will relate them to the use and context of the project, starting an iterative process in which all phases of the project will be improved. Continuous data management can also help to recognize what kind of data are most useful and offer better services to the clients.

8.6 IMPLICATIONS AND CONCLUSIONS

Services in traditional PBFs had been considered in the past as an activity that brought little value to this type of business (Marceau & Martinez, 2002). However, a change is happening and civil engineering companies are now revaluing their business models towards finding associated services.

Through the outputs of this work, different implications may be observed.

First, we have made an effort to study the factors that favor the inclusion of services in the civil engineering companies (Table 1). The proposed factors that we studied as enablers are: complexity, customization, duration of the project, life span, client, innovation, risks, supplier and contract. A good knowledge of these enablers will allow a more successful implementation of servitization strategy in this type of business.

Secondly, a model for servitization strategy in civil engineering companies has been proposed (figure 3). This implementation model relies on the use of smart technologies. The study of this model can inspire in the introduction of new services during the different project phases and the obtaining of new competitive advantages. Following this study, we can distinguish generically three types of benefits that encourage investment for the inclusion of services: financial, given increase of incomes and greater stability thereof. Strategic, as they can attract advantages in terms of value, differentiation and quality. And benefits related to Marketing, thanks to an increased client satisfaction, improved client proposals and an increase of the credibility of the company (Kujala et al., 2013).

On the other hand, the development of new technologies must be observed by the managers as a facilitating tool of servitization strategy. We have observed how through these technologies is possible to create new and attractive services.

The use of services based on smart technologies provides a wealth of data on the performance of delivered project. In this research we have tried to emphasize the importance of proper data management. Based on this knowledge is possible to obtain competitive advantages such as a continuous improvement of the different phases of the project and the creation of new services better tailored to project environment and client needs.

To sum up, companies should redouble their efforts to obtain knowledge to understand better the infrastructure behavior during execution and life-cycle. In line with this approach, civil engineering firms must be able to build a database of different projects, clients and environments. By having the appropriate information, firms would have the possibility of comparing different clients, settings and contexts for the development of a better tailored project management.

PART III

CONCLUSIONS AND IMPLICATIONS

CAPÍTULO IX

FINAL CONCLUSIONS AND IMPLICATIONS

9.1 INTRODUCTION

In this final Chapter we will try to extract main conclusions that can be obtained throughout this research. In the first section we collect the most relevant conclusions for each Chapter of this thesis. Subsequently, we will focus on the implications arising from the work developed, distinguishing theoretical implications and implications affecting more practical or managerial levels. In the final part of the Chapter we will identify the limitations of the study and we encourage follow proposed research lines associated with the results obtained and in accordance with the orientation of this work.

The aim of this final chapter is allow the reader to better understand all key points that emerge from the research carried out, trying to synthesize and highlight the findings and implications which are based on the development of the study and that finally add value to this thesis.

9.2 GENERAL CONCLUSIONS

To enable a better understanding of the conclusions derived from this thesis, we will make a tour through the different chapters that we have presented in order to sort the conclusions following the story line of work. To that end we define the main ideas and key concepts, gathering the knowledge on which this research is underpinned and that finishes in practical studies carried out in chapters 7 and 8, whose meaning and significance are more easily understood after the comprehension of previous chapters. This section also tries to condense the conclusions that meet the objectives presented at the beginning of this thesis.

In Chapter 2 is made a tour through value conceptualization, trying to understand the historical evolution of the concept and the different perspectives from which has been studied its creation and perception.

Analyzing its conceptualization we observe how the notion of value has been a matter of debate and controversy from ancient Greece (Fleetwood, 1997) to the present day and has been studied from the most diverse areas of knowledge. Examining its historical evolution, we conclude that the classical view of the Economy conceived the value as value "in exchange" and that conceptualization was applied in a generalized way in the area of Management (Beckman, 1957; Drucker; Woodruff, 1997).

From the perspective of Management, the conceptualization of value "in exchange" has several implications: the value is considered as an intrinsic condition for the product or service; the value is unilaterally created by companies (Porter, 1980); and customers are considered passive actors who are outside the process of value creation (McKee et al., 1989; Moran & Ghoshal, 1996).

Closely related to the classic conceptualization of value arises the Good Dominant logic. According to this dominant logic of value creation, it the firm, which exclusively, through its operations creates value and distributes it on the market. The consumer only perceives the value in the act of exchange between goods and money (Vargo et al., 2008). The market is understood as the point where this "exchange" takes place. Consequently, following this logic, the relationships and interactions between consumers and firms are not considered as potential sources of value creation (Normann & Ramirez, 1994; Wikström, 1996).

Certain limitations on the conceptualization of value "in exchange" are identified: this vision considers that the process of value creation culminates in the act of selling a product or delivering a service, thus, the perceived value by the customer is determined solely on the amount that customer is willing to pay (Grönroos, 2008; Normann, 2001). Moreover, this view of value underestimates

the importance of context and contingencies surrounding the client during the act of consumption (Ng & Smith, 2012).

The last part of Chapter 2 is devoted to the study of conception and perception of value in Project Management. This area has specific characteristics in terms of value creation (Cicmil et al., 2006) that necessitates further particularized study particularized towards to define the research carried out in the second part of this thesis.

The concept of value in project-based firms and in Project Management arises initially associated with the optimization of the processes taking place in a project and with the concept of "value management" (Green, 1994; Thiry, 2002). However, these guidelines were too focused on cost reduction and failing to provide a more global view of value creation in projects.

Traditionally, value creation in PBFs has been focused on the delivery of the project output, understanding that end result as a "product" (Laursen & Svejvig, 2015). Therefore, the creation of value in this field has focused on what is known as "iron triangle" in project management, that is, to deliver projects on the appropriate terms of time, quality and budget.

However, this view of value creation in PM stirs controversy, as the delivery of a project, even in proper term of quality, time and budget does not guarantee value for companies or for customers (Winter & Szczepanek, 2008). To this must be added other peculiarities of perception of value in the projects: on the one hand, the perception of value can vary depending on the perspective of different stakeholders involved in it (Lepak et al., 2007). On the other hand, companies are beginning to understand that the value of the project is basically perceived by consumers or users during the operation thereof.

As a result of the above, some of the most comprehensive and current research reviews in the field of project management consider the creation and perception of value as one of the areas that need further research (Winter et al.,

2006; Winter & Szczepanek, 2008). What justifies and has promoted the realization of this thesis.

In chapter 3 we focused on a new perspective of the concept of value: the value “in use”. Also we analyzed its implications in business management and in the creation of new strategies

Carrying our focus back to classical approaches of value creation, we find that the conception of value “in exchange” has been historically opposed to the vision of the value “in use”, both views have been linked since the beginning of economic exchange, assuming that what demonstrated value “in use”, acquired value “in exchange” for other goods or money. Back to the field of business management and current theories, this concept of value “in use” results in a new dominant logic of value creation: the Service- Dominant Logic (Vargo & Lusch, 2004). This new logic holds that the value is evaluated during use, and the “consumer experience” is a key factor in determining the value (Lusch & Vargo, 2006).

One of the key features of the Service-Dominant logic is that the customer is no longer considered a passive element in the generation of value to assume the role of co-creator of value (Vargo & Lusch, 2004). That is, the value is co-created between customers and firms through the integration of operands and operant resources that take place during interactions and consumption practices. The main implication derived from this assumption is that companies should start changing their strategies and focus on the development of interaction and dialogue with customers (Payne et al., 2008).

Under this perspective, the way in which companies compete is transformed to no longer depend solely on their own activities and operations, but the entire ecosystem (manufacturing, suppliers and customers). This new way of competing implies a major challenge for strategic management, because need to provide new strategies that facilitate continuous and customized interactions with consumers (Prahalad & Ramaswamy, 2004). In fact, the quality of these interactions becomes a key factor, as proper interactions are

able to convert knowledge, experience and skills of customers in potential competitive advantages (Xiang & Rongqiun, 2006).

The Service-Dominant Logic has also implications for the value chain: under this logic, the goal is to create value throughout the chain as a whole, including customers and suppliers (Choi & Kim, 2008). Proper implementation of the value chain following the S-D logic can represent the establishment of a source of competitive advantage (F. Bustinza et al., 2013).

As a result of this new conceptualization of value, new management strategies emerge. Among those have been highlighted co-creation and customerization

The implementation of co-creation strategy focuses on the development of actions to achieve a better understanding of the customers experiences and expectations that allow firms to introduce customers in the process of value creation (Grönroos, 2011b; Payne et al., 2008) and enable a better identification of their needs and desires (Lusch & Vargo, 2006). To achieve this objective it is important to develop new and better methods of interaction with customers during the process of value creation, even trying to motivate and improve their ability to co-create value (Jaworski & Kohli, 2006). Successful adoption of co-creation strategy allows maximizing the perceived value by customer and create long-term relationships with target customers (Payne & Frow, 2005).

Customerization strategy is based on creating value together with consumers through dynamic interactions during provision of products or services (Wind & Rangaswamy, 2001) and plays a key role in the introduction of services associated with products (Sanchez et al., 2015; Zhang & Chen, 2008). Through the development of customerization, can be developed customized offerings to customers, but also operational capabilities can be jointly developed (Wind & Rangaswamy, 2001). Customerization basically seeks to offer customized products and services able to engage customers with brands associating those goods or services with positive personal experiences (Wind et al., 2001).

The adoption of these new strategies that follow S-D logic and are based on the concept of value “in use” are allowing develop an improved and closer communication with customers, whose result is a better understanding of their preferences and needs (Ng et al., 2015). It implies to achieve a better understanding of what business processes and what features of a product / service add more value for each type of customer (Osterwalder et al., 2015; Parry et al., 2012).

On the other hand, the development of processes that enable greater customer involvement in the creation of value results in the emergence of positive phenomena for companies such as: fidelity, co-production and identification(Vargo & Lusch, 2004). Among them, the process of identification, in which customer identifies elements of their own identity in the identity of the company is of particular importance in that regard, as it allows the company to access to certain competitive advantages (Bhattacharya & Sen, 2003): company loyalty, firm promotion, customer recruitment and resilience to negative information.

The notion of value “in use” and the strategic implications that we are analyzing, guide companies toward greater service orientation that is studied in the fourth chapter of this thesis. The key to a service orientation is that the provision of services, by its very nature, requires more contact with customers (Metters & Maruchek, 2007) and allows the development of more lasting relationships (Rifkin, 2000). Hence the link that exists between the provision of services and the development of new strategies in value creation.

Servitization strategy can be defined as the addition of services to the traditional firm offerings (Vandermerwe & Rada, 1989). In some productive sectors that means a significant transformation in the model business, which changes from a focus on selling products to be based on offering complete solutions enabled by services. However, the management of this strategic change is sometimes difficult to be carried out and that section of the thesis tries to shed light on it.

Depending on their complexity and value proposition, we can distinguish three types of services: basic, intermediate and advanced (Baines & Lightfoot, 2013a). Among them, advanced services, which are those that deliver a “capacity” to customers through the performance of the goods supplied, are playing a more prominent role in the development of Servitization strategies and, as we have observed, they also present remarkable link with the development of new technologies.

The adoption and development of Servitization strategy underlies two current factors: A diminishing interest in the ownership of the goods; and the reconfiguration of the relationship between user and provider in which relations become supported by continuous interactions and assistance from provider to user during operation of goods (Kamp, 2016).

If we look at the strategic objectives for Servitization adoption, we note that basically respond to two types of motivations (Baines et al., 2016b):

- Defensive motivations: focused on defending the efficiency and viability of businesses, complicating the possibility of competition and improving the predictability of income and costs

- Offensive motivations: aimed at increasing competitiveness and number of customers. Servitization also influences the innovation capacity of firms, allowing them to develop innovations whose diffusion and acceptance in the market will be assured.

Different studies show how in an overall way, Servitization provides competitive differentiation (Baines & Lightfoot, 2013a) and increases customer satisfaction (Raja et al., 2013). This conclusions result into different advantages, among them can be pointed out; uniformity of income streams, an increase of customers, increased resilience as a result of the diversification of supply and improvement in the processes of innovation and R & D of the company.

From the standpoint of customers who hire services, their benefits are derived from risks reduction (both technical and financial), significant initial savings and increased safety and reliability of goods acquired.

However, it notes that there are also significant difficulties associated with the process of adoption. These barriers are primarily associated with corporate culture, and arise mainly from a lack of understanding of the process by senior management, as well as from the absence of outsourcing culture (Sánchez) (Arias-Aranda et al., 2011). Other barriers that appear are associated with lack of capacity to provide advanced services, particularly because of the implementation and development of technologies and information systems which can be required (Dickson et al., 2008; Gebauer, 2008; Oliva & Kallenberg, 2003).

Finally and to close conclusions of this chapter are include some implications of the Servitization in global and regional economy. According to several studies, there is a positive correlation between Servitization and economic growth, both regionally and nationally (Clegg et al., 2013; Neely, 2008; Vendrell-Herrero & Wilson, 2014). It is considered that Servitization allow firms from advanced economies to compete against the low production costs of companies in developing countries. It is also remarkable the influence of Servitization in technological innovations for an entire ecosystem. However, there is controversy regarding the implications of Servitization in the creation or job destruction (Michel et al., 2008).

We have been observing how starting from conceptualization of value “in use”, the implementation of strategies based on the S-D logic (such as Servitization, Co-creation or Customerización) requires continuous and smooth relationships with customers in seeking to achieve a better understanding of use experiences. But not only that, as noted in the previous chapter, the development of advanced services goes a step further and also requires advance understanding of operation itself of systems or products delivered. In that context monitoring technologies, connectivity, storage capacity and data analysis acquire a major role in creating value (Grubic, 2014). Chapter 5

discusses the importance of digitization for the implementation of new services and strategies based on the creation of value "in use", defining also the main relevant technologies in achieving this goal.

The use of the technology associated to value creation begins primarily with the use of communication tools that improve the fluidity and continuity of customer-firm interactions (Chen & Popovich, 2003). In this line, the development of the Internet had a great influence to drive co-creation of value, as it allowed the establishment of a direct and continuous dialogue with the customer as well as access to collective intelligence, also allowing customers to play a more active role in value generation (Prahalad & Ramaswamy, 2004).

In recent years is taking place an important technological revolution, primarily affecting sensorization, connectivity and storage and analysis capacities. These developments are exponentially increasing the possibilities for the development of advanced services and the access to "real" experiences of use, consumption and operation (Parry et al., 2015).

Currently are arising a series of technologies that from the standpoint of value creation can consider "service-oriented technologies". These technologies are and will be increasingly critical in developing Servitization strategies. In Chapter 6 are analyzed a number of emerging technologies that are geared toward meeting these strategic purposes. These technological developments include: monitoring technologies, Internet of things, cloud computing, pervasive computing, Big Data and visualization tools. During this chapter 5 a study of its potential and usefulness in value creation and development of advanced services is performed.

Thus, it can be held that digitization emerges as a key element for new value creation and is destined to play a key role in shaping future business models. New technologies, by collecting and analyzing massive amounts of data finally allow accessing to information (from customer, experiences and operations) that until now was impossible to get.

Today can already be distinguished some business areas in which the digitization process starts to show greater influence and potential (Maglio & Lim, 2016): Smart operation management, prevention, customization, smart coaching, smart adaptation and risk management..

Likewise, some economic sectors are also beginning to excel in the use and exploitation of the digitization process: Health Care, Administration and Public Sector, Manufacturing, Retail, Geo-localization, Logistics and Transport.

Once analyzed some of the applications and benefits resulting from business digitalization, we must also recognize some current barriers to value extraction from this process. On the one hand some technologies are too novel and many companies find risky to embark on its implementation within their business (Loebbecke & Picot, 2015), in other cases the application of disruptive technologies within a sector drives to the growth of emerging business networks which are particularly complex to manage, limiting firms ability to obtain value (Schroeder & Galera-Zarco, 2016). Other barriers refer to; cultural challenges, the controversy regarding data privacy (Terzi et al., 2015), lack of skills and personnel with appropriate training, the difficulty of designing monitoring architectures and analysis data in each productive sector, the need for support from senior management and above all, the lack of business models adapted to this new technological reality (Russom, 2011).

After this first part of the thesis more focused on contextualization and theoretical development, the research was oriented towards a more practical application of the concepts and theories raised. In this part we studied servitization and digitization phenomena within companies that base their activity on projects. By way of introduction of this second part, in Chapter 6 the importance and characteristics of value creation in projects are analyzed.

Research in value creation stands as one of the priority research lines in project management (Winter et al., 2006). The creation of value in projects should be viewed from a broader perspective increasingly associated with

global strategic objectives of the company (Morris & Pinto, 2004; Shenhar & Dvir, 2004; Turner, 2014). It is also necessary to realize that true value of projects is closely related with value perceived by the customer (private client, receiving organization or Society at large) (Lepak et al., 2007).

This implies the need to develop new theories, concepts and business models that fit in the new perspective value creation and are oriented to customer satisfaction (Winter & Szczepanek, 2008), overcoming finally the tendency to put the focus of value creation in the project itself and leaving behind models inspired by the "value chain" adopted from other productive sectors.

In the pursuit of achieving these objectives, it seeks to demonstrate that Servitization strategy emerges as an effective process in the transformation of business models in project based firms (PBFs), driving them towards greater customer orientation. PBFs trying to provide "integrated solutions" through projects require a better understanding of the needs and expectations of clients as well as an improved ability to control and act on the operation of the project at all stages. Technologies acquire an important role in achieving these goals. However, the introduction of new technologies in project management and development is a sensitive process that requires a detailed study (Linderoth & Pellegrino, 2005). Therefore in Chapter 6 monitoring architectures oriented to project management are analyzed.

Sometimes a single company does not have the necessary dynamic capabilities to offer a "comprehensive solution" either by the complexity of the required technology or because this "solution" includes activities or services offerings which are beyond the usual skills of a particular company (Möller, 2010; Möller & Svahn, 2009). This is an increasingly common scenario in modern, complex and advanced projects which is pushing to the creation of business networks and "partnerships" (Gomes, Angwin, Weber, & Yedidia Tarba, 2013; Gomes, Mellahi, Sahadev, & Harvey, 2015).

In Chapter 7 is conducted a study on the adoption of the Servitization strategy oriented to PBFs from the energy efficiency architecture sector. Business models in PBFs have specific characteristics compared to other productive sectors, mainly because projects have an intimate relationship with the context in which they are developed, which increases the degree of uncertainty and minimizes the chances of standardization. This is also reflected in special features for value creation (Hellström & Wikström, 2005).

The sector of architectural firms that base their projects on energy efficiency is postulated as an ideal scenario for the study of servitization in PBFs, due to technological innovations developed in this field, and their peculiarities in design, installation, maintenance, operation and use. In addition, this is favorable sector for the study of servitization process because of two factors: its characteristics of technical innovation and the importance of ensuring profitability during lifecycle of the project in order to justify a higher initial investment. Therefore, throughout the study performed it is possible to observe a growing inclusion of services in all project phases, especially in the phases of pre-project delivery, where the inclusion of services of energy and technical consulting becomes relevant. It is also significant inclusion of services related to the operation and maintenance of this energy-efficient infrastructures, mainly because of the important role that develop for generating benefits derived from energy savings.

Regarding emerging business models in project based firms, can be said that this sector is leaving behind focus on the outputs of the project and achieving broaden the approach to the whole project process and subsequent lifecycle. Also it showed a growing trend to add services at all stages of the project (Kujala et al., 2010) and try to offer a "global solution" through the integrated management of all phases of the project by the same company (Haroglu & Leiringer, 2010).

The case study reveals that most business models adopted in this sector include the provision of services in the pre-project delivery phase, however the customer relationship ends with the delivery of the project. This means firms are

currently waiving the provision of operation and maintenance services that would allow extending the customer relationship and would give firms access to greater competitive advantages.

Finally, in Chapter 8 an investigation that seeks to increase awareness on the implementation of Servitization process in engineering firms was performed. Technological taxonomy of services is also proposed in order to collaborate in shaping servitized business models in that sector.

To achieve this objective, factors that favor the integration of services in the business model of companies that focus their activities on projects were determined and a propositive study was conducted with the objective of define services based on new technologies and adapted to be included in each phase of engineering project. The proposed model opens the door to co-create value with customers and access to data and information on the project and subsequent operation in order to generate a feedback process that allows accessing to competitive advantages and continuous improvement processes.

9.3 RESEARCH IMPLICATIONS

9.3.1 Theoretical Implications

This study responds to the need of delving into the concept of value “in use” and advance in a whole implementation of Service-Dominant Logic in value creation (Vargo & Lusch, 2004). On the basis of the genesis of the notion of value, this work explains the transformation that is occurring from a conception of value “in exchange” towards a conception of value “in use” (Ballantyne & Varey, 2006). This new perspective reveals that customer interactions and access to a better understanding of consumer experiences are key to achieving the co-creation of value together customers and create value in a better alignment with expectations and real needs of customers (Ng et al., 2015).

This notion of value “in use” also implies a new conceptualization of the value chain (Bustinza et al., 2015), as well as the abandonment of firm-centric

perspective of value creation towards a customer-centric view (Xiang & Rongqiun, 2006).

On the other hand, this thesis expand the knowledge of strategies based on this new concept of value creation through detailed study of conditions for successful implementation of co-creation and customerization (Prahalad & Ramaswamy, 2004; Wind & Rangaswamy, 2001).

Of particular interest in this research is the goal of creating new knowledge in the development of Servitization process (Vandermerwe & Rada, 1989), helping to better understand the organizational changes, benefits and barriers related to the adoption of this strategy. And above all, this thesis look to extend the application of Servitization in business fields apart from manufacturing, as in the case of project-based firms and Project Management.

In this line, this work goes further in the study of value creation in projects, which is one of the main lines in which research is needed within Project Management theories (Winter et al., 2006). This study seeks to collaborate in conceptualization of business strategies which are more based on global business level and less focused on the execution and delivery of projects.

Another theoretical implication is to collaborate in the identification of business digitalization as the great enabler in which support new business strategies grounded on introducing advanced services (Grubic, 2014). Our contribution is taxonomy of fundamental technologies linked to the creation of value “in use” as well as a study of the potential of these technologies in business.

Finally, the research expand the knowledge in implementation of strategies and business models based on services adapted to project business, seeking to advance in Project Management theories. In this line, several arguments for the adoption of servitization strategy in PFFs are identified: economic factors, customer orientation and obtaining competitive advantages. Impacts of services in business model of the PBFs and conditions to be met by projects to facilitate the addition of services are determined. To conclude,

propositional structures for the introduction and management of advanced services in business models within this sector are proposed.

9.3.2 Managerial Implications

This research also seeks to provide practical implications with real benefits for managers. In this regard, the structure of the thesis allows readers to progress in knowledge, motivations and justifications that have led to a new conception value creation, explaining in chronological way the changes that have taken place and that have led to current situation in which technologies and services are becoming increasingly important in the development of strategies and business models.

Our practical implications focus PBFs sector, there have been conducted two studies that collaborate in an active way and eminently practical to understanding the needs of implementation of services as a core part of business model in this kind of firms and also the role of services as particular catalyst to understand the value creation in Project Management in a more comprehensive way.

To achieve this goal in Chapter 7 an adapted structure for business models in PBFs is proposed, through this framework we can distinguish the different business models that firms from this sector can adopt. In this framework we delimitate three phases in projects with its associated services: pre-project delivery, project delivery and post-project delivery. Likewise, the establishment of more direct and lasting relationships with clients throughout the project is also recommended (Kujala et al., 2010) to facilitate reaching situations where the client obtain projects better tailored to his needs and inspirations and in which client is also able to better predict the behavior of the delivered project during its life-cycle.

On the other hand, also in Chapter 7 performed study of the impact of services on PBFs' business models facilitates the identification of services that positively impact on business models. This will allow managers to be more

aware about influence of certain services in business model and implement strategies in order to make more attractive and adapted offers to their clients.

We propose a model of integrated management of all phases of the project by the same company ("full package") as the best servitized business model as it let achieve greater competitive advantages (Oliva & Kallenberg, 2003; Tukker & Van Halen, 2003; Windahl et al., 2004). This integrated management allows firms to interact with the client from the earliest stages of the project, developing jointly solutions in which the customer is aware of the advantages and disadvantages of the decisions taken (Ernst, 2002). In this line, integrating development of all phases (design- implementation (execution)- operation) by the same company has a number of significant advantages: it allows better planning and lowers levels of technical and economic uncertainty (Blindenbach-Driessen & Van Den Ende, 2006). On the other hand, services introduced in most advanced stages of the project will be will be supplied with higher quality and in a more effective way if firms have accumulated project information during previous phases (Bennett & lossa, 2006; Martimort & Pouyet, 2008).

Another practical implication is the identification of factors in projects that favor the inclusion of services and enable managers to better determine the chances of success of including services depending on project characteristics. The factors identified were: complexity, customization, duration of the project, life span, client, innovation, risk, supplier and contract. For each of these factors, characteristics most likely to including service are analyzed.

In Chapter 8, the conducted study results in a model of servitization strategy for engineering firms which is focused on the use of innovative technologies for the introduction of services and adapted to the different phases. This framework distinguished generically three types of benefits arising from following the proposed model:

- Financial benefits: Increased income and greater stability thereof

- Strategic: Competitive advantages in terms of value, differentiation and quality. Processes of continuous improvement of services and project management itself

- Marketing: Increased customer satisfaction, increased credibility of the company and offerings more customized

The use of digitization through services supply, especially those related to the operation and performance of delivered project brings to the company a significant amount of data. In this study we wanted to emphasize the importance of a proper analysis and management of data obtained through the services that allows obtaining competitive advantages through:

- 1) Improvements in design, implementation, execution, operation and maintenance of a project as a result of an objective and realistic knowledge (through data analysis) on all processes and contingencies surrounding a project.

- 2) Creating new services from monitoring and data analysis For example: traffic control services or structural health monitoring in infrastructures.

- 3) Sale of data on behavior and use patterns of an infrastructure developed by the company. These data may be useful for administrations either companies that will undertake similar projects.

In this line (especially in construction-related sectors) PBFs must strive to collect all possible data which could help them to better understand the behavior of an infrastructure, both during their execution and their life cycle. The implementation of databases including different projects, clients and contexts in which have been developed is strongly recommended. The greater the information and analysis capabilities at disposal, the better project management and the greater customization of projects firms may offer.

Finally, the need of reconfiguring organizational structures within PBFs to better develop servitization strategies is proposed (Barnett et al., 2013). Creation of new services departments and increased focus on innovation throughout the whole organization is needed. On the other hand it has been also identified the need for the government administrations, as the major bidding project, to be more aware about the positive effects of servitization in projects and begin promoting the inclusion of quality services as decisive factor in the processes of public bidding for projects.

From case study we also observe that companies in this sector must adopt organizational structures that allow them to offer "comprehensive project management". Gradual changes that allow adaptation of the structures of these firms to offer this solutions are needed (Barnett et al., 2013)

9.4 LIMITATIONS

The main limitation of this study resides in the use of an inductive methodology, in which, from theoretical study, individual cases and application examples seek to extrapolate results and generate knowledge and implications. However, this methodology can be considered as suitable for a first approach to subject of study studying management processes (Gummesson, 2000). In inductive and qualitative studies as ours, the development of a solid theoretical framework is an important part of the overall research that benefits the rest of the study (Strauss, 1987). That is why this research has given special importance to the establishment of robust theoretical contextualization throughout the development of the first part of this thesis.

Another important limitation of this research resides on the use of single case study methodology in Chapter 7. This methodology is characterized by the absence of methodological guidelines (Yin, 2009), and above all, findings cannot be generalized with the same degree of certainty that quantitative analysis (Eisenhardt, 1989).

Thus, this research recognizes their limitations compared to quantitative studies, as presented a character descriptive (identifying concepts, factors and technologies that affect the servitization process); explanatory (looking for links between variables using theoretical rationality) and predictive to try to shed light on the reality of servitization and digitalization in project-oriented companies. In addition, such studies may show ambiguities or be influenced by the author's perspective to the facts observed.

The propositive nature of this thesis in some phases of the research is consequence of a subject of study which sometimes focuses on strategies and technological developments that have not yet been implemented, at least in a general way, within PBFs and project management. In fact, many of the proposed services are based on technologies recently implemented and in some cases are only being developed in an experimental way linked to R & D projects in Universities and companies.

In general, the small number of companies belonging to the analyzed sectors which nowadays are adopting servitization and digitalization as priorities business strategies, greatly limits the realization of a quantitative analysis able to add theoretical strength to results obtained.

These limitations provide opportunities for future research, which will discuss in next point.

9.5 FUTURE RESEARCH LINES

Following the story's time line of the presented thesis, we propose below future research in relation to some theoretical and practical developments in which detected the presence of interesting lines still unexplored.

After the research carried out on value co-creation in Chapter 3, the study of the customer motivations to co-create value is proposed, as a lack of attention from Literature is observed to determine that factors encourage (or not) consumers to participate in a process, which has been noted, is ultimately beneficial to the Firm.

On the other hand, studies in Chapters 4 and 5 show the need to go deeper into the implications of the adoption of the Servitización and Digitization on organizational structures, trying to determine the organizational benefits that can be derived from these phenomena.

In the process of analyzing Business Digitalization arises the need to increase the study of barriers to extract value from this process, especially regarding the configuration of emerging business networks and generation of interdependencies during this process, which sometimes causes difficulty to achieve success in strategies that need high technology services. Likewise, we propose to increase research studies focused on understanding the value "in use" through sensing and monitoring technology in products and systems during actual use.

We have exposed the use of single case study methodology in Chapter 7 as limitation. Therefore, we encourage the realization of multiple case study including several companies with different business volumes and belonging to different international markets, so that, it would be possible to get a more realistic generalization of the findings and a better evaluation of developed proposals.

Finally, from research carried out in Chapter 8, it follows that it would be interesting to check the impact of the implementation of a database of all projects undertaken by a company. The objective would be to study the real implications of managing and analyzing all data collected and accumulated during design, implementation and operation of different projects, correlating them with the contexts in which they are executed, client types and stakeholders involved.

CAPÍTULO IX

CONCLUSIONES FINALES E IMPLICACIONES

10.1 INTRODUCCIÓN

En este capítulo final vamos a tratar de extraer las principales conclusiones que pueden ser obtenidas a lo largo de éste trabajo de investigación. En un primer apartado trataremos de recopilar las conclusiones más relevantes de cada uno de los capítulos que configuran esta tesis. Posteriormente, nos centraremos en las implicaciones que se derivan del trabajo desarrollado, distinguiendo las implicaciones a nivel teórico y las implicaciones que afectan a niveles más prácticos o de gestión. En la parte final del capítulo nos centraremos en reconocer las limitaciones del estudio y en la propuesta de futuras líneas de investigación asociadas a los resultados obtenidos y en concordancia con la orientación de éste trabajo.

El objetivo de este capítulo final es permitir al lector una mejor comprensión de todos los puntos clave que se desprenden de la investigación desarrollada, tratando de sintetizar y resaltar las conclusiones e implicaciones que se fundamentan en el desarrollo de éste estudio y que aportan finalmente valor a esta tesis doctoral.

10.2 CONCLUSIONES DEL TRABAJO DE INVESTIGACIÓN

Para permitir una mejor comprensión de las conclusiones que se derivan de la presente tesis, realizaremos un pasaje por los diferentes capítulos que hemos presentado, lo que permitirá ordenar las conclusiones siguiendo la línea argumental del trabajo. Con este objetivo definiremos las ideas principales y conceptos clave, recopilando el conocimiento sobre el que se va sustentando este trabajo de investigación y que culmina en los estudios más prácticos efectuado en los capítulos 7 y 8, cuyo significado y trascendencia son más fácilmente entendibles tras la comprensión de los capítulos anteriores. En este

apartado trataremos asimismo de condensar las conclusiones que responden a los objetivos marcados al inicio de esta tesis doctoral.

En el capítulo 2 se realizó un recorrido por la conceptualización de valor, tratando de comprender la evolución histórica del concepto y las diferentes perspectivas desde las que se ha estudiado su creación y percepción.

Atendiendo a su conceptualización observamos cómo la noción de valor ha sido objeto de debate y controversia desde la antigua Grecia (Fleetwood, 1997) hasta nuestros días y ha sido estudiada desde las más diversas áreas de conocimiento. Analizando esa evolución histórica, llegamos a la conclusión de que la visión clásica de la Economía concibió el valor como valor “en intercambio” y esa conceptualización fue la que se aplicó de un modo generalizado en el área del Management (Beckman, 1957; Drucker; Woodruff, 1997).

Desde la perspectiva del Management, la conceptualización del valor “en intercambio” tiene diversas implicaciones: el valor se considera como una condición inherente al producto o servicio, el valor es creado unilateralmente por las compañías (Porter, 1980) y los consumidores son considerados actores pasivos que se encuentran fuera del proceso de generación de valor (McKee et al., 1989; Moran & Ghoshal, 1996).

Íntimamente relacionado con esta conceptualización clásica del valor surge la Good Dominant logic. De acuerdo con esta lógica dominante en creación de valor, es la empresa en exclusiva, la que, a través de sus operaciones crea el valor y lo distribuye en el mercado. El consumidor sólo percibe el valor en el acto de intercambio entre bienes y dinero (Vargo et al., 2008), definiéndose el Mercado como el punto donde éste “intercambio” tiene lugar. En consecuencia, y siguiendo esta lógica, las relaciones e interacciones entre consumidores y empresas no son consideradas como posibles fuentes de creación de valor (Normann & Ramirez, 1994; Wikström, 1996).

Se identifican sin embargo ciertas limitaciones en la conceptualización del valor “en intercambio”: esta visión considera que el proceso de creación de valor culmina con la acto de venta de un producto o servicio, por lo que la percepción del valor por parte del consumidor se determina únicamente en la cantidad que el consumidor está dispuesto a pagar (Grönroos, 2008; Normann, 2001). Por otra parte, y no menos importante, esta concepción del valor subestima la importancia del contexto y las contingencias que rodean al cliente durante el acto de consumo service (Ng & Smith, 2012).

La última parte del capítulo 2 está dedicada al estudio de la concepción y percepción de valor en la gestión de proyectos. Esta área presenta características particulares en cuanto a la creación de valro (Cicmil et al., 2006) que hacen necesario un estudio más particularizado de cara a las investigaciones desarrolladas en la segunda parte de ésta tesis.

La concepción del valor en las empresas basadas en proyectos y en el Project Management surge inicialmente asociada a la optimización de los procesos que tienen lugar en un proyecto y al concepto de “*value management*” (Green, 1994; Thiry, 2002). Sin embargo, estas orientaciones estaban demasiado enfocadas a la reducción de costes y se demuestran incapaces de aportar una visión más global de la creación de valor en proyectos.

Tradicionalmente, la creación de valor en las empresas de proyectos se ha centrado en la entrega del resultado del proyecto, asimilando fundamentalmente ese resultado final a un “producto” (Laursen & Svejvig, 2015). Por ello, la creación de valor en este campo ha centrado sus esfuerzos en lo que se conoce como “triángulo de acero” de la gestión de proyectos, es decir, entregar los proyectos en los términos adecuados de tiempo, calidad y presupuesto.

Sin embargo, esta perspectiva de la creación de valor en PM suscita controversia, pues la entrega de un Proyecto, aun en buenos términos de calidad, tiempo y presupuesto no garantiza valor para empresa ni para el cliente (Winter & Szczepanek, 2008). A ello hay que añadir otras

particularidades de la percepción del valor en los proyectos: de un lado, la percepción del valor puede variar según la perspectiva de los diferentes stakeholders implicados en el mismo (Lepak et al., 2007). De otro lado, las empresas comienzan a comprender que el valor del proyecto es fundamentalmente percibido por los consumidores o usuarios durante la operación del mismo.

Como consecuencia de lo anterior, algunas de las revisiones más completas y actuales en el campo de gestión de proyectos, consideran que el problema de la creación y percepción de valor es una de las áreas que necesitan futura investigación (Winter et al., 2006; Winter & Szczepanek, 2008). Lo que justifica y ha impulsado la realización de esta tesis doctoral.

En el capítulo 3 nos centramos en una nueva perspectiva de la concepción de valor: el valor en uso. Asimismo analizamos sus implicaciones en la gestión empresarial y la generación de nuevas estrategias

Retrotrayendo nuestro foco a las perspectivas clásicas para entender la creación de valor, encontramos que a la concepción del valor en intercambio, se ha contrapuesto históricamente la visión del valor en uso, ambas se han relacionado desde los inicios del intercambio económico, asumiendo que lo que demostraba valor durante su uso, adquiriría valor para su intercambio por otros bienes o dinero. De vuelta al campo del gestión empresarial y sus teorías actuales, esa concepción de valor en uso deriva en una nueva lógica dominante para la creación de valor: la Service- Dominant Logic (Vargo & Lusch, 2004). Ésta nueva lógica pronostica que el valor es evaluado durante su uso, y la experiencia de consumo del producto o servicio es un factor clave en la determinación del valor (Lusch & Vargo, 2006).

Una de las características claves de la Service-Dominant logic es que el cliente deja de considerarse un elemento pasivo en la generación de valor para asumir un rol de co-creador del valor (Vargo & Lusch, 2004). Es decir, el valor es co-creado entre los consumidores y las empresas mediante la integración de recursos operandos y operantes que se produce en las interacciones y

prácticas de consumo. La principal implicación que se deriva de ello es que las empresas deben comenzar a modificar sus estrategias y poner el foco en el desarrollo de las interacciones y el diálogo con sus consumidores (Payne et al., 2008).

Bajo esta perspectiva, el modo de competir de las empresas se transforma, al no depender ya únicamente de su propia actividad y operaciones, sino del ecosistema completo (manufacturas, suministradores y clientes). Este nuevo modo de competir implica un importante desafío para la gestión estratégica, que necesita aportar nuevas estrategias capaces de facilitar interacciones continuas y customizadas con los consumidores (Prahalad & Ramaswamy, 2004). De hecho la calidad de estas interacciones se convierte en un factor clave, dado que permiten convertir el conocimiento, experiencias y habilidades de los consumidores en potenciales ventajas competitivas (Xiang & Rongqiun, 2006).

La Service-Dominant Logic también tiene implicaciones sobre la cadena de valor: bajo esta lógica el objetivo es generar valor a lo largo de toda la cadena como conjunto, incluyendo a los consumidores y suministradores (Choi & Kim, 2008). Una adecuada implementación de la cadena de valor siguiendo la S-D logic puede representar el establecimiento de una fuente de ventajas competitivas (F. Bustinza et al., 2013)

Como resultado de esta nueva conceptualización de valor surgen nuevas estrategias de gestión. Entre las que se han destacado la co-creación y la customerización.

La implementación de estrategia de co-creación se centra en el desarrollo de acciones que permitan alcanzar una mejor comprensión de las experiencias y expectativas de los consumidores, introduciéndolos en el proceso de creación de valor (Grönroos, 2011b; Payne et al., 2008) y posibilitando una mejor identificación de sus necesidades y deseos (Lusch & Vargo, 2006). Para alcanzar dicho objetivo es importante prestar atención y desarrollar nuevos y mejores métodos de interacción con los clientes durante

todo el proceso de generación de valor, incluso tratando motivar y mejorar sus habilidades para co-crear valor (Jaworski & Kohli, 2006).

Una adopción exitosa de esta estrategia permite maximizar el valor percibido por el cliente e incrementar la duración de las relaciones con los clientes-objetivo (Payne & Frow, 2005).

La customerización es una estrategia basada en la creación de valor en conjunto con los consumidores a través de interacciones dinámicas durante la provisión de productos o servicios (Wind & Rangaswamy, 2001) y juega un papel fundamental para la introducción de servicios asociados a productos (Sanchez et al., 2015; Zhang & Chen, 2008). A través del desarrollo de la customerización, no sólo se pueden desarrollar ofertas customizadas a los clientes, sino incluso desarrollar conjuntamente capacidades operacionales (Wind & Rangaswamy, 2001)

La customerización busca ofrecer productos y servicios customizados capaces de involucrar a los clientes con las marcas y asociar esos productos o servicios con experiencias personales positivas (Wind et al., 2001).

La adopción de estas nuevas estrategias fundamentadas en la concepción del valor en uso y la lógica dominante de servicios están permitiendo desarrollar una comunicación mejorada y más cercana con los consumidores, lo que se traduce en un mejor entendimiento de sus preferencias y necesidades (Ng et al., 2015). Ello arroja como consecuencia una mejor comprensión de qué procesos de la empresa y qué características de un producto / servicio añaden más valor para cada tipo de consumidor (Osterwalder et al., 2015).

Por otro lado, el desarrollo de procesos que permiten una mayor implicación del cliente en la creación de valor en conjunto con la empresa trae como consecuencia el surgimiento de fenómenos positivos para las empresas como: la fidelidad, la co-producción y la identificación (Vargo & Lusch, 2004). De entre ellos, el proceso de identificación, por el que el consumidor llega a

identificar elementos de su propia identidad en la identidad de la empresa es de particular importancia, dado que permite a la empresa el acceso a ciertas ventajas competitivas (Bhattacharya & Sen, 2003): lealtad a la empresa, promoción, captación de clientes y resistencia a informaciones negativas.

La noción de valor en uso y las implicaciones estratégicas que venimos analizando, guían a las empresas hacia una mayor orientación a los servicios que es estudiada en el cuarto capítulo de esta tesis. La clave de esa orientación a los servicios se halla en que la provisión de servicios, por su propia naturaleza, requiere de un mayor contacto con los consumidores (Mettters & Maruchek, 2007) y permite el desarrollo de relaciones más duraderas (Rifkin, 2000). De ahí el vínculo existente entre la provisión de servicios y el desarrollo de nuevas estrategias para la generación de valor.

La estrategia de servitización, que es analizada a lo largo de ese capítulo, puede ser definida como la adición de servicios a la oferta tradicional de las empresas (Vandermerwe & Rada, 1989), lo que en algunos sectores significa una transformación significativa en el modelo de negocio, que pasa de centrarse en la venta de productos para hacerlo en el ofrecimiento de soluciones completas basadas en servicios. Sin embargo, la gestión de éste cambio estratégico en ocasiones es difícil de desarrollar y en ese apartado de la tesis tratamos de arrojar luz sobre el mismo.

Atendiendo a su complejidad y proposición de valor, se pueden distinguir tres tipos de servicios: básico, intermedios y avanzados (Baines & Lightfoot, 2013a) . De entre ellos, los servicios avanzados, que son aquellos que entregan una “capacidad” al cliente a través de la operación de un bien suministrado son los que juegan un rol más preponderante en el desarrollo de las estrategias de servitización y los que, como hemos observado, presentan un vínculo más trascendente con el desarrollo de las nuevas tecnologías.

La adopción y desarrollo de la estrategia de Servitización se deriva fundamentalmente de dos factores actuales: una disminución del interés por

parte de clientes de poseer bienes en propiedad, y una nueva configuración de las relaciones entre cliente y proveedor facilitada por la posibilidad de interacciones más continuas y una asistencia de operación cada vez más efectiva (Kamp, 2016).

Este proceso, sin embargo, implica importantes transformaciones tanto para los clientes como para las empresas suministradoras. Fundamentalmente cambios organizacionales que afectan a la cultura, gestión de personal y procesos internos (Martinez et al., 2010). Por otro lado, otro importante cambio organizacional se deriva de la necesidad de adoptar nuevas herramientas tecnológicas para la implementación de servicios avanzados (Lightfoot et al., 2011).

Si atendemos a los objetivos estratégicos de la adopción de la servitización observamos que básicamente atienden a dos tipos de motivaciones (Baines et al., 2016b):

-Motivaciones Defensivas: centradas en defender la eficiencia y viabilidad de los negocios, complicando la posibilidad de competencia y mejorando la previsibilidad de los ingresos y costes

-Motivaciones Ofensivas: orientadas al incremento de su competitividad y número de clientes. La servitización también influye en la capacidad de innovación de las empresas, permitiendo desarrollar innovaciones cuya difusión y aceptación en el mercado estarán aseguradas.

Diferentes investigaciones muestran como de un modo global la adopción de la servitización entrega diferenciación (Baines & Lightfoot, 2013a) e incrementa la satisfacción de los clientes (Raja et al., 2013). A nivel más particular esto se traduce en diferentes ventajas entre las que destacan la mayor uniformidad de las corrientes de ingreso, un incremento de clientes, una mayor resiliencia como consecuencia de la diversificación de la oferta y una mejora en los procesos de innovación e I+D de la empresa.

Desde el punto de vista de los clientes que contratan servicios, sus beneficios se derivan de la disminución de riesgos (técnicos y financieros), así como de los importantes ahorros iniciales y la mayor seguridad en la operación de los bienes suministrados.

Sin embargo, cabe destacar que también existen importantes dificultades asociadas al proceso de adopción de la estrategia de Servitización. Estas barreras están fundamentalmente asociadas a la cultura de las empresas, y surgen principalmente de la falta de comprensión del proceso por parte de la alta dirección, así como de la ausencia de una cultura de contratación externa (Sánchez) (Arias-Aranda et al., 2011). Otras barreras que aparecen están asociadas a la falta de capacidades para suministrar servicios avanzados, en particular con la implementación y desarrollo de tecnologías y sistemas de información necesarios (Dickson et al., 2008; Gebauer, 2008; Oliva & Kallenberg, 2003).

Por último y para cerrar las conclusiones de éste capítulo, cabe destacar las implicaciones del fenómeno de la servitización en la economía global y territorial. De acuerdo con varios estudios existe una correlación positiva entre servitización y crecimiento económico, tanto a nivel regional como nacional. (Clegg et al., 2013; Neely, 2008; Vendrell-Herrero & Wilson, 2014). Se considera que la servitización puede constituir una herramienta de las empresas de las economías avanzadas para competir contra los bajos costes de producción de empresas pertenecientes a países en vía de desarrollo. Se considera también que la servitización potencia la innovación tecnológica. Sin embargo existe controversia en cuanto a las implicaciones de la servitización en la creación o destrucción de empleo (Michel et al., 2008)

Venimos observando cómo partiendo de conceptualización de valor en uso y la implementación de estrategias fundamentadas en la S-D logic (como la servitización, co-creación o customerización) exigen relaciones continuas y fluidas con los consumidores en la búsqueda de alcanzar una mejor comprensión de las experiencias de uso. Pero no sólo eso, como observamos en el capítulo anterior, el desarrollo de los servicios avanzados va un paso más

allá y exige también avanzar en el entendimiento de la propia operación de los sistemas o productos entregados. Es en este contexto donde las tecnologías de monitorización, conectividad, almacenamiento y análisis adquieren un papel muy relevante en la creación de valor (Grubic, 2014). El capítulo 5 analiza la importancia de la digitalización para la implementación de nuevas estrategias basadas en la creación de valor “en uso” y define las principales tecnologías relevantes en la consecución de éste objetivo.

El empleo de la tecnología asociada a la creación de valor se inicia primariamente con el uso de herramientas de comunicación que permiten mejorar la fluidez y continuidad de las interacciones empresa–cliente, empresa–suministrador y cliente–cliente (Chen & Popovich, 2003). En ésta línea el desarrollo de internet tiene una gran influencia en el desarrollo de la co-creación de valor, ya que permitió el establecimiento de un diálogo directo con el consumidor y el acceso a la inteligencia colectiva, posibilitando asimismo a los consumidores adoptar un rol más activo en la generación de valor (Prahalad & Ramaswamy, 2004).

En los últimos años, se está produciendo una importante revolución tecnológica, afectando principalmente a la sensorización, la conectividad y el incremento en la capacidad de almacenamiento y análisis de datos. Estos avances están aumentando exponencialmente las posibilidades en el desarrollo de servicios avanzados y en el acceso a experiencias “reales” de uso, consumo y operación (Parry et al., 2015)

Actualmente se están desarrollando una serie de tecnologías que desde el enfoque de la creación de valor podemos considerar “tecnologías orientadas a los servicios” y que son y serán cada vez más fundamentales en el desarrollo de estrategias de servitización. En éste capítulo son analizadas una serie de tecnologías emergentes que se orientan hacia el cumplimiento de estos propósitos estratégicos. Entre ellas cabe destacar: las tecnologías de monitorización, internet de las cosas, computación en la nube, computación pervasiva, Big Data y las herramientas de visualización. Durante éste capítulo 5 se realiza una taxonomía de las tecnologías actuales orientadas a la creación

de valor, de modo que se obtenga conocimiento de su potencial y utilidad en la generación de valor y el desarrollo de servicios avanzados.

Así pues, se puede afirmar que la digitalización surge como un elemento fundamental en la nueva concepción de la creación de valor y está destinado a jugar un papel clave en la configuración de los futuros modelos de negocio. Las nuevas tecnologías, mediante la recopilación y análisis de ingentes cantidades de datos permiten finalmente el acceso a una información (del cliente, de su experiencia y de la operación de bienes o sistemas) a la que hasta ahora resultaba imposible acceder.

A día de hoy se pueden ya distinguir algunas áreas de negocio en las que la digitalización de los procesos comienza a demostrar una mayor influencia y potencial (Maglio & Lim, 2016): gestión inteligente de operaciones, prevención, customización, entrenamiento inteligente, adaptación inteligente y gestión de riesgos.

Asimismo, algunos sectores económicos también comienzan a destacarse en el empleo y aprovechamiento del proceso de digitalización: cuidado de la Salud, Administración y Sector Público, ventas, localización, logística y transporte y manufactura.

Una vez analizadas algunas de las aplicaciones y beneficios derivadas de proceso de digitalización en los negocios, hemos de reconocer también las barreras actuales que se presentan para la extracción de valor en este proceso. De una parte algunas tecnologías son excesivamente novedosas y a muchas empresas les resulta arriesgado embarcarse en su implementación dentro del negocio (Loebbecke & Picot, 2015), en otros casos la aplicación de tecnologías disruptivas dentro de un sector impulsa el crecimiento de redes emergentes de negocio que resultan complejas de gestionar, restando a las empresas capacidad para obtener el valor (Schroeder & Galera-Zarco, 2016). Otras barreras hacen referencia a los desafíos culturales, la controversia en cuanto a la privacidad de datos (Terzi et al., 2015), la falta de desarrollo de habilidades y personal con la adecuada formación, la dificultad de diseñar arquitecturas de

monitorización y análisis de datos en cada sector productivo, la necesidad de apoyo de la alta dirección y sobre todo, la falta de modelos de negocio adaptados a la nueva realidad tecnológica (Russom, 2011).

Tras estos esta primera parte de la tesis más focalizada en la contextualización y desarrollo teórico, la investigación se orientó hacia una aplicación más práctica de las teorías planteadas, centrándonos en el estudio de la servitización y digitalización dentro de las empresas que basan su actividad en proyectos. A modo de introducción de esta segunda parte en el Capítulo 6 se analizó la importancia y características de la creación de valor en la las empresas que basan su actividad en proyectos.

La investigación en creación de valor se sitúa como una de las líneas de investigación prioritarias en gestión de proyectos (Winter et al., 2006). La generación de valor en los proyectos debe ser observada desde una perspectiva más amplia que se asocie con objetivos estratégicos globales para la empresa (Morris & Pinto, 2004; Shenhar & Dvir, 2004; Turner, 2014), comenzando al mismo tiempo a entender el verdadero valor de los proyectos como el valor percibido por el cliente (cliente privado, organización receptora o sociedad en general) (Lepak et al., 2007).

Ello implica la necesidad de desarrollar nuevas teorías, conceptos y modelos de negocio que se encuadren en la nueva perspectiva de la creación de valor y se orienten a alcanzar la satisfacción del cliente (Winter & Szczepanek, 2008), superando por fin la tendencia a poner el foco de la creación de valor en el proyecto en sí y dejando atrás los modelos inspirados en la “cadena de valor” provenientes de otros sectores productivos.

En la búsqueda del cumplimiento de estos objetivos, se busca demostrar que la estrategia de servitización surge como una estrategia efectiva en la transformación de los modelos de negocio de las empresas basadas en proyectos (PBFs) hacia una mayor orientación al cliente y creación de valor en conjunto.

Las PBFs van a tratar de proveer “soluciones integradas” a través de los proyectos, lo que requerirá un mejor conocimiento de las necesidades y expectativas de los clientes y una capacidad mejorada para conocer y actuar sobre la operación del proyecto en todas sus fases. Las tecnologías adquieren un papel fundamental para la consecución de éstos objetivos. Sin embargo, la introducción de las nuevas tecnologías en la gestión y desarrollo de los proyectos es un proceso sensible que requiere un estudio pormenorizado (Linderoth & Pellegrino, 2005). Por ello en éste capítulo se analizan arquitecturas de monitorización orientadas a la gestión de proyectos.

En ocasiones, una empresa individual no presenta las capacidades dinámicas necesarias para una ofrecer al cliente una “solución integral”, bien por la complejidad de la tecnología requerida o bien porque esa “solución” incluye actividades o el ofrecimiento de servicios que se escapan de las competencias habituales de una empresa particular (Möller, 2010; Möller & Svahn, 2009). Éste es un escenario cada vez más habitual en proyectos modernos, complejos y avanzados que está impulsando a la creación de redes de negocio o “*partnerships*”.

El capítulo 7 desarrolló un estudio sobre la adopción de la estrategia de Servitización orientada a las PBFs del sector de la arquitectura de eficiencia energética. Los modelos de negocio de las PBFs presentan características específicas respecto a otros sectores productivos, principalmente porque los proyectos presentan una íntima relación con el contexto en el que se desarrollan, lo que incrementa el grado de incertidumbre y minimiza las posibilidades de estandarización. Ello se refleja también en unas características especiales para la creación de valor (Hellström & Wikström, 2005).

El sector de las empresas de arquitectura que basan sus proyectos en la eficiencia energética se postula como un marco ideal para el estudio de la servitización en las PBFs, debido a las innovaciones tecnológicas que se desarrollan en este campo, y a sus particularidades en diseño, instalación, mantenimiento, operación y uso. A lo largo del estudio realizado se identifica a éste como un sector favorable al desarrollo de estrategias de servitización

fundamentalmente por dos factores: sus características de innovación técnica y la importancia de obtener una rentabilidad durante el ciclo de vida del proyecto que justifique una mayor inversión inicial. Por tanto, es posible observar una creciente inclusión de servicios en todas las fases del proyecto, especialmente en las fases de pre-entrega del proyecto, donde la inclusión de servicios de consultoría energética y técnica adquiere relevancia. Asimismo, es significativa la inclusión de servicios relacionados con la operación y mantenimiento de estas infraestructuras de eficiencia energética, fundamentalmente por el importante papel que desarrollan a la hora de generar beneficios derivados del ahorro energético.

En cuanto a los modelos de negocio que están emergiendo en las empresas basadas en proyectos se puede afirmar que este sector está consiguiendo abandonar el foco en el resultado del proyecto y su entrega y logrando ampliar el enfoque a todo el proceso de proyecto y posterior ciclo de vida. Asimismo se comienza a observar una creciente tendencia a añadir servicios en todas las etapas del proyecto (Kujala et al., 2010) y a tratar de ofrecer una “solución global” a través de la integración de la gestión de todas las fases del proyecto en una misma empresa (Haroglu & Leiringer, 2010).

El caso de estudio realizado nos desvela que los modelos de negocio más adoptados en este sector incluyen mayoritariamente la prestación de servicios en las fases de pre-ejecución del proyecto, sin embargo la relación con el cliente finaliza con la entrega del proyecto. Ello significa que actualmente se renuncia a la prestación de servicios de operación y mantenimiento que permitirían alargar la relación con el cliente y darían acceso a mayores ventajas competitivas.

Finalmente, en el capítulo 8 se realizó una investigación que busca incrementar el conocimiento sobre la implementación de la estrategia de servitización en el ámbito las empresas de ingeniería, particularizando en el sector de la ingeniería civil. Asimismo se propone una taxonomía de servicios tecnológicos que pretenden colaborar en la configuración de modelos de

negocio servitizados que permitan a las empresas de este sector adaptarse a la nueva conceptualización de la generación de valor.

Para alcanzar este objetivo se determinaron factores que favorecen la integración de servicios en el modelo de negocio de las empresas que centran su actividad en proyectos y se realizó un estudio propositivo de servicios basados en nuevas tecnologías y adaptados para ser incluidos en cada una de las fases de un proyectos. El modelo propuesto abre la puerta a la co-creación de valor con los clientes y al acceso a datos e información sobre el desarrollo del proyecto y su posterior operación que configuran un proceso de retroalimentación que permite el acceso a ventajas competitivas y a procesos de mejora continua.

10.3 IMPLICACIONES DEL TRABAJO DE INVESTIGACIÓN

10.3.1 Implicaciones Teóricas

Este estudio parte de la necesidad de profundizar en la nueva conceptualización del valor en uso y avanzar en la aplicación de la lógica dominante de servicios (Vargo & Lusch, 2004). Para ello parte de la génesis de la concepción de valor y explica la transformación que se está produciendo desde una concepción del valor “en intercambio” hacia una concepción del valor “en uso” en la que se pone de manifiesto que las interacciones con el cliente y el acceso a un mejor conocimiento de las experiencias de consumo resultan claves para alcanzar la co-creación de valor y crear valor en concordancia con las expectativas y necesidades reales de los clientes (Ng et al., 2015).

Ello implica una nueva conceptualización de la cadena de valor (Bustinza et al., 2015), así como el abandono de una visión centrada en la empresa para la creación de valor hacia una creación de valor centrada en el cliente(Xiang & Rongqiun, 2006).

Por otro lado, esta tesis profundiza en el conocimiento de las estrategias basadas en esta nueva concepción de la creación de valor, estudiando pormenorizadamente la implementación de estrategias de co-creación, y customerización (Prahalad & Ramaswamy, 2004; Wind & Rangaswamy, 2001).

De especial interés en esta investigación es el objetivo de generar conocimiento en el desarrollo de la estrategia de Servitización (Vandermerwe & Rada, 1989), colaborando a conocer mejor los cambios organizacionales, beneficios y barreras relacionadas con la adopción de esta estrategia y fundamentalmente buscando extender la aplicación de éste proceso a sectores diferentes a la manufactura, como es el caso de las empresas basadas en proyectos y el Project Management.

En esta línea trata de avanzar en una de las principales necesidades de investigación definidas en la gestión de proyectos (Winter et al., 2006) como es la creación de valor. Este estudio trata de colaborar en la concepción de la estrategia de las empresas basadas en proyectos a un nivel más global de estrategia de negocio y menos centrada en la ejecución y entrega de proyectos.

Otra de las implicaciones es la colaboración en la identificación y puesta en valor de del empleo de las digitalización de los negocios como gran posibilitador en el que apoyar nuevas estrategias de negocio fundamentadas en la introducción de servicios avanzados, avanzando en las propuestas de (Grubic, 2014). Para ello se realiza una taxonomía de las tecnologías fundamentales relacionadas con la generación de valor en uso y un estudio del potencial de estas tecnologías en ésta línea.

Finalmente se logra generar conocimiento para la gestión e implementación de estrategias y modelos de negocio servitizados y basados en la digitalización para la empresas basadas en proyectos y la gestión de proyectos. Colaborando al avance de la teoría de gestión de proyectos y de la servitización (Baines et al., 2016a; Cicmil et al., 2006; Laursen & Svejvig, 2015)

Se identifican argumentos para la adopción de la estrategia de servitización en PBFs: factores económicos, de orientación al cliente y de

obtención de ventajas competitivas. Se observan los impactos de los servicios en el modelo de negocio de las PBFs y se buscan las condiciones que deben cumplir los proyectos para facilitar la adición de servicios. Proponiendo finalmente estructuras propositivas para la introducción y gestión de servicios avanzados en empresas del sector.

10.3.2 Implicaciones Prácticas

Esta investigación también busca aportar implicaciones prácticas y de utilidad real para gestores. Principalmente su estructura permite ir avanzando en el conocimiento, motivaciones y justificaciones que han llevado hacia una nueva concepción de la nueva generación de valor, comprendiendo de un modo cronológico los cambios que se han ido produciendo y que nos llevan a la situación actual en la que las tecnologías y los servicios están adquiriendo una importancia creciente en el desarrollo de nuevas estrategias y modelos de negocio.

Nuestras implicaciones teóricas se centran en el sector de las PBFs, donde se han realizado dos estudios que colaboran de un modo activo y eminentemente práctico a la comprensión de las necesidades de implementación de los servicios como parte activa del modelo de negocio de este tipo de empresas y como especialmente como catalizador para entender la creación de valor de un modo más global en la gestión de proyectos.

Para ello en el capítulo 7 se propone una estructura adaptada para las PBFs en la que se observan los diferentes modelos de negocio que este tipo de empresas pueden adoptar. En ella se distinguen tres fases: pre-entrega de proyecto, entrega de proyecto y post-entrega de proyecto. Asimismo se proponen diferentes servicios que pueden ser incluidos durante cada una de éstas fases. También se recomienda el establecimiento de relaciones más directas y duraderas con el cliente a lo largo del proyecto (Kujala et al., 2010) que faciliten alcanzar situaciones en las que el cliente obtenga proyectos más

adaptados a sus necesidades e inspiraciones y en los que sea capaz de predecir mejor el comportamiento del proyecto entregado durante su vida útil.

Por otro lado, el estudio del impacto de los servicios en los modelos de negocio de los PBFs, facilita la identificación de servicios que impactan positivamente hacia un modelo de negocio servitizado. Ello permitirá a los gestores ser más conscientes de la influencia de determinados servicios en el modelo de negocio e implementar estrategias con el objetivo de realizar ofertas más atractivas y adaptadas sus clientes

Asimismo se propone un modelo de gestión integral de todas las fases del proyecto *“full package”* como el mejor modelo de negocio servitizado y el que permite alcanzar mayores ventajas competitivas (Oliva & Kallenberg, 2003; Tukker & Van Halen, 2003; Windahl et al., 2004). Esta gestión integral permite interactuar con el cliente desde las etapas más iniciales, desarrollando soluciones conjuntas en las que el cliente sea partícipe y consciente de las ventajas y desventajas de las decisiones adoptadas (Ernst, 2002). En esta línea, la integración del desarrollo de todas las fases (diseño-ejecución-operación) por una misma empresa presenta una serie de ventajas significativas: permite una mejor planificación y disminuye los niveles de incertidumbre técnica y económica (Blindenbach-Driessen & Van Den Ende, 2006). Por otro lado, los servicios que se van introduciendo en las fases más avanzadas del proyecto será de mayor calidad y más efectivos si se cuenta con el conocimiento acumulado durante la gestión de las fases anteriores (Bennett & Iossa, 2006; Martimort & Pouyet, 2008)

Otra implicación práctica es la identificación de factores en los proyectos que favorecen la inclusión de servicios y que colaboran a que los gestores puedan determinar mejor las posibilidades de éxito de incluir servicios para diferentes tipos de proyectos. Los factores identificados fueron: la complejidad, la personalización, la duración del proyecto, duración del ciclo de vida, el cliente, la innovación, los riesgos, el proveedor y el contrato. Para cada uno de estos factores se analizan las características más proclives a la inclusión de servicios.

En el capítulo 8 se propone modelo de estrategia de servitización orientado para empresas de ingeniería y centrado en el empleo de tecnologías actuales para la introducción de servicios en éste campo y adaptados a las diferentes fases de la que consta un proyecto. De este modelo se distinguen de un modo genérico tres tipos de beneficios que se derivan de la inclusión de este tipo de servicios:

- Financieros: Aumento de ingresos y mayor estabilidad de los mismos
- Estratégicos: Ventajas competitivas en términos de valor, diferenciación y calidad. Procesos de mejora continua de los servicios y de la propia gestión del proyecto
- Marketing: Incremento en la satisfacción del cliente, de la credibilidad de la empresa y ofrecimiento de mayor personalización

El empleo de la digitalización en el ofrecimiento de servicios, especialmente en los relacionados con la operación y desempeño del proyecto entregado, aporta a la empresa una cantidad importante de datos. En este estudio hemos querido enfatizar la importancia de un análisis y gestión adecuada de los datos obtenidos a través de los servicios que permite la obtención de ventajas competitivas a través de:

1) Mejoras en el diseño, implementación, ejecución, operación y mantenimiento de un proyecto como consecuencia de un conocimiento objetivo y realista (a través de análisis de datos) acerca de todos los procesos y contingencias que rodean un proyecto.

2) Creación nuevos servicios a partir de la monitorización y análisis de datos
Por ejemplo: servicios de control de tráfico o los servicios de mantenimiento y vigilancia de la salud estructural en infraestructuras.

3) Venta de datos sobre los patrones de comportamiento o uso de una infraestructura desarrollada por la empresa. Estos datos pueden ser útiles para Administraciones u empresas que van a emprender proyectos similares.

En ésta línea las PBFs (especialmente en los sectores relacionados con la construcción) deben esforzarse en obtener todos los datos posibles que les ayuden a comprender mejor el comportamiento de una infraestructura, tanto durante su ejecución como en su ciclo de vida. Recomendándose la implementación de bases de datos con los diferentes proyectos, clientes y contextos en los que se han desarrollado. Cuanta mayor sea la información y capacidad de análisis de la que dispongan las empresas, mejor gestión de los proyectos y mayor customización de los proyectos podrán ofrecer.

Por último, se destaca la necesidad de adoptar estructuras organizacionales dentro de las PBFs que permitan el mejor desarrollo de estrategias de servitización, (Barnett et al., 2013) con la creación de nuevos departamentos y una mayor orientación a la innovación en toda la estructura de éste tipo de empresas. Por otro lado también se ha detectado la necesidad de que las Administraciones Públicas, como las grandes licitadoras de proyectos, sean más conscientes del efecto de la servitización en los proyectos y que la inclusión de servicios de calidad comience a ser un factor decisivo en los procesos de licitación pública de proyectos.

Del estudio de caso realizado se desprende que las empresas de este sector deben adoptar estructuras organizacionales que les permitan ofrecer esa “gestión integral de los proyectos”. Se necesitan cambios graduales que permitan la adaptación de las estructuras de este tipo de empresas al ofrecimiento de servicios (Barnett et al., 2013)

10.4 LIMITACIONES DEL ESTUDIO

La principal limitación de este estudio reside en el empleo de una metodología inductiva, en la cual a partir del estudio teórico, casos particulares y ejemplos de aplicación se pretenden extrapolar resultados y generar

conocimiento e implicaciones. Sin embargo, esta metodología se puede considerar adecuada para una primera aproximación a problemas-objeto de que estudian fenómenos de empresa (Gummesson, 2000). En estudios inductivos y cualitativos como el llevado a cabo, el desarrollo de un marco teórico sólido es una parte importante de la investigación que beneficia globalmente el resto del estudio (Strauss, 1987). Es por ello que esta investigación ha conferido especial importancia al establecimiento de esa contextualización teórica a lo largo de todo el desarrollo de la primera parte de esta tesis.

Otra importante limitación de esta investigación se centra en el uso de la metodología de caso de estudio simple en el Capítulo 7. Esta metodología se caracteriza por la ausencia de guías metodológicas (Yin, 2009), y sobre todo por el hecho de que los resultados no pueden ser generalizados con el mismo grado de certeza que los derivados de análisis cuantitativos (Eisenhardt, 1989).

Así pues, esta investigación reconoce su limitación respecto a estudio cuantitativos, presentando un carácter descriptivo (identificando conceptos, factores y tecnologías que inciden en la servitización); explicativo (buscando los vínculos entre variables con la suficiente racionalidad teórica) y predictivo con el que se trata de arrojar luz sobre la realidad de la servitización y la digitalización en las empresas orientadas a proyectos. Sin embargo, este tipo de estudios pueden presentar ambigüedades o verse influenciados en exceso por la perspectiva del autor hacia los hechos observados

El carácter propositivo de esta tesis en algunas fases de la investigación es consecuencia de que el objeto de estudio se centra en ocasiones en estrategias y desarrollos tecnológicos que aún no han sido implementadas, al menos de un modo genérico, dentro de las empresas de proyectos y en la gestión de proyectos. Muchos de los servicios propuestos se basan en tecnologías de reciente implementación y que en algunos casos sólo se están desarrollando de un modo experimental en relación con proyectos de I+D en universidades y empresas.

En general, el reducido número de empresas pertenecientes a los sectores analizados que hayan optado actualmente de un modo prioritario por la adopción de estrategias de servitización limita en gran medida la realización de un tipo de análisis más cuantitativo que proveyese de una mayor solidez teórica a los resultados obtenidos.

Algunas de las limitaciones presentadas presentan una oportunidad para la provisión de futuras líneas de investigación que son discutidas en el siguiente apartado.

10.5 FUTURAS LÍNEAS DE INVESTIGACIÓN PROPUESTAS

Siguiendo la línea argumental en que se ha presentado esta tesis, se proponen a continuación futuras líneas de investigación en relación a algunos desarrollos teóricos y prácticos en los que se ha detectado la presencia de líneas interesantes aún sin explorar.

Tras el estudio desarrollado sobre la co-creación de valor desarrollado el Capítulo 3, se propone el estudio de las motivaciones de los consumidores en la co-creación de valor junto a las empresas, dado que se observa una falta de atención de la literatura hacia los procesos que incentivan (o no) a los consumidores a participar de éste proceso, que como se ha observado, es finalmente beneficioso para la empresa

Por otro lado, de los estudios llevados a cabo en los capítulos 4 y 5, se deriva la necesidad de profundizar más en las implicaciones de la adopción de la Servitización y la Digitalización sobre las estructuras organizativas de las empresas, para tratar de determinar los beneficios organizacionales que se pueden derivar de estos fenómenos

En el análisis del proceso de Digitalization de negocios, se detecta la necesidad de incrementar el estudio de las barreras existentes para la extracción de valor, en especial respecto a la configuración de redes emergentes de negocio y la generación de interdependencias durante este proceso, lo que en ocasiones está demostrando que ocasiona dificultades para la consecución del éxito de estrategias de servicios que necesitan de alta

tecnología. Asimismo se propone el incremento de estudios de investigación centrados en el conocimiento del valor “en uso” mediante tecnologías de sensorización y monitorización para productos y sistemas durante su uso real

Hemos expuesto como limitación de estudio la utilización de metodología de caso de estudio simple en el Capítulo 7. Por tanto, se propone la realización de un caso de estudio múltiple con empresas del sector propuesto, pero con diferentes volúmenes de negocio y pertenecientes a diferentes mercados internacionales, de modo que la generalización de los resultados arrojados sea más realista.

Finalmente, de la investigación realizada en el capítulo 8, se desprende que sería interesante la comprobación del impacto de la implementación de una base de datos de proyectos realizados por una empresa, en la que se consigan gestionar todos los datos acumulados durante el diseño, ejecución e implementación de proyectos, correlacionándolos con los contextos en los que se ejecutan, los tipos de cliente y los stakeholders implicados.

ANNEXES

ANEXOS

Nombre del entrevistado:

Empresa:

Fecha:

CUESTIONARIO

Nombre del artículo: **SERVITIZATION AND BUSINESS MODELS IN PROJECT-BASED FIRMS: THE CASE OF ENERGY EFFICIENT ARCHITECTURE**

El propósito de la entrevista es recoger datos que nos permitan conocer mejor el modelo de negocio de empresas dentro del sector de la arquitectura basada en criterios de eficiencia energética. Por otro lado se pretende estudiar el grado de servitización dentro de dichos modelos y proponer medidas para incrementarlo.

¿Cuál es su función dentro de la compañía? ¿Cuál ha sido, es o será su función dentro del desarrollo del/ los proyecto/s de viviendas de eficiencia energética?

Temas y Cuestiones

1. CONSUMIDOR

- ¿Podría suministrar una descripción del consumidor tipo en esta clase de proyectos?
- ¿Qué segmento del mercado es objetivo de la empresa? ¿Qué características definirían este segmento de mercado?
- ¿Cómo describiría la capacidad del cliente para la gestión de las instalaciones del proyecto? ¿Piensa que Influye la innovación tecnológica en dicha capacidad?

- ¿Cómo describiría la estrategia de compra del cliente, los factores decisivos del mismo a la hora comprar una vivienda de eficiencia energética y optar por unos servicios u otros?
- ¿Cómo describiría la relación con el cliente, antes, durante y después del proyecto?
- ¿Se desarrolla algún tipo de estrategia desde la empresa para mantener una relación duradera con el cliente?

2. DEMANDA

- ¿Qué es exigido por el consumidor en el proyecto? (Consultoría, Diseño, Construcción, Instalaciones, Mantenimiento, Operaciones)
- ¿Cómo fueron formuladas o especificadas las necesidades del cliente? ¿Dejan espacio las demandas específicas del cliente para las opciones de diseño propuestas por la empresa?
- ¿Consigue influenciar la empresa en lo que el cliente demanda? ¿Cómo clasificaría porcentualmente la influencia de cliente y empresa en el proyecto que finalmente se construye?
- ¿Trata la empresa de incluir servicios que no fueron inicialmente demandados por el cliente?

3.OFERTA

- ¿Cuáles son las actividades ofrecidas por la empresa antes del proyecto, durante el proyecto y después del proyecto?
- ¿Se ofrece al cliente un estudio de viabilidad y análisis de Riesgos?
- ¿Se realiza un análisis económico en el que se prevea el retorno de la inversión en la tecnología de eficiencia energética?

- ¿Hubo algún producto o servicios ofrecidos que no fueron inicialmente demandados por el cliente?
Asesoramiento / Consultoría / Diseño / Formación / Mantenimiento / Operaciones / etc.
- ¿Se ofrece al cliente un “paquete completo” en el que se oferten todos los productos o servicios ofrecidos por la compañía (Consultoría, Diseño, Proyecto, Construcción, Mantenimiento, Operación)? ¿Qué ventajas cree que podría reportar este “paquete completo”?
- ¿Ofrecía la oferta al cliente una solución con el coste del ciclo de vida más bajo? ¿Por qué?
- ¿Considera que a través de la explotación y mantenimiento de instalaciones se pueden obtener datos útiles que mejoren el diseño en futuros proyectos? ¿Por qué?

4.LICITACIÓN

- ¿Podría explicar el método de licitación?
- ¿Qué criterios sigue la compañía para licitar por un proyecto?
- ¿Cuáles fueron los criterios de adjudicación? ¿Cuál considera que fue de la ventaja competitiva de la propuesta presentada por la compañía?
- ¿Afectó el método de licitación a la oferta? ¿Y cómo?

5. ORGANIZACIÓN EXTERNA

- ¿Quiénes eran las otras partes interesadas en el proyecto, y cuáles fueron sus roles?
- ¿Hubo algún tipo de asociación con otra u otras compañías?
- ¿Hubo un interés común entre las partes interesadas en el proyecto, o intereses en conflicto?
- ¿Cómo participó el cliente en el proyecto? ¿Cuál era el papel del cliente?

6. ORGANIZACIÓN INTERNA

- ¿Puede describir los procesos que tuvieron lugar en la empresa, antes, durante y después del proyecto?
- ¿Qué departamentos están involucrados en cada momento del proceso?
- ¿Estuvo el departamento de servicios involucrados en el diseño?
- ¿Puede dar un ejemplo de cómo los aspectos relacionados con servicios futuros cambiaron el diseño?

7.CONTRATO

- ¿Qué tipo de contrato es normalmente utilizado y por qué?
- ¿Cuáles son los indicadores de rendimiento claves en el contrato?
- ¿Se realiza un contrato diferente en función de los servicios ofrecidos o existe la posibilidad de integrar varios servicios en un mismo contrato?
- Consultoría, Diseño, Proyecto, Construcción, Mantenimiento, Operación

8.MODELO DE INGRESOS

- ¿Podría describir qué clase de ingresos que se generan durante el proceso? Antes, durante y después del proyecto.
- ¿Qué fase genera la mayor cantidad de ingresos?
- ¿Son los ingresos determinados desde el inicio del proyecto o dependientes del desarrollo del proyecto?
- ¿Existe una estrategia de la compañía para aumentar los ingresos del proyecto?
- ¿Es esta estrategia basada en los servicios?

9.RESULTADOS

¿Cómo es evaluado el resultado final del proyecto?

- ¿Qué otros aspectos se evalúan a parte del resultado económico?
- ¿Cómo definiría un proyecto exitoso para la empresa y para el cliente?

REFLEXIÓN

- ¿Tiene algún punto adicional que le gustaría resaltar a parte de los mencionados anteriormente?

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