



Dynamics of service innovation management and co-creation in firms in the digital economy sector

Dinámica de la gestión de la innovación de servicios y co-creación en empresas del sector economía digital

Rafael Luis Herrera González^{1*}, Antonio Hidalgo Nuchera²

¹Universidad de Costa Rica, Costa Rica

²Universidad Politécnica de Madrid, España

Received September 14, 2017; accepted October 17, 2018

Available online November 25, 2018

Abstract

This paper analyzes the process of innovation management in the ICT sector that is framed in the context of the digital economy, with special emphasis on the co-creation activities carried out by companies. Taking as a starting point the main theoretical considerations on innovation in services, a six-phase innovation model based on the TEMAGUIDE model is proposed, which incorporates two new phases, one related to the management of human resources and the other relative to the capacity of co-creation. The results obtained show that the aggregation of value requires to carry out co-creation processes where different actors are involved.

JEL codes: M11, M30, O30, O31, Q33

Keywords: services; innovation management; co-creation; digital economy; ICT.

* Corresponding author.

E-mail address: rafael.herrera@ucr.ac.cr (R. L. Herrera González)

Peer Review under the responsibility of Universidad Nacional Autónoma de México.

Resumen

En este trabajo se analiza el proceso de la gestión de innovación en el sector TIC que se enmarca en el contexto de la economía digital, prestando especial énfasis en las actividades de co-creación que realizan las empresas. Tomando como punto de partida las principales consideraciones teóricas sobre la innovación en servicios se plantea un modelo de innovación de seis fases basado en el modelo TEMAGUIDE, al cual se le incorporan dos nuevas fases, una relativa a la gestión de los recursos humanos y otra relativa a la capacidad de co-creación. Los resultados obtenidos ponen de relieve que la agregación de valor requiere de realizar procesos de co-creación en donde se involucren diferentes actores.

Código JEL: M11, M30, O30, O31, Q33

Palabras clave: Innovación; servicios; gestión de la innovación; co-creación; economía digital; TIC.

Introduction

According to Tapscott (1995), the digital economy is characterized by three fundamental aspects: it is based on the application of human knowledge to everything that is produced and how it is produced, which makes it possible to affirm that more and more added value will be created by the brain instead of muscular force; it helps modify the structure of the current economic system through the convergence between computing (hardware, software), communications (cable telephony, satellite, wireless), and content (entertainment, publishing, information providers); and information in all its forms becomes digital and is reduced to bits stored in computers that are distributed at a high-speed across networks. As a result, the number of businesses generated in the digital economy sector shows exponential growth (Elkelsen, Marcus and Ferree, 2009) within the four ways of classifying companies that make up the digital economy sector: pure digital goods and services, mixed digital goods and services, ICT-intensive production of goods and services, and ICT industry (OEI Foundation, 2010).

The revolution in information and communication technologies (ICTs) has enabled it to become an indispensable tool for the implementation of numerous processes of socioeconomic transformation (Castells, 2001), in particular the so-called digital economy. ICTs have helped improve performance in previously stagnant service sectors by facilitating communication, reducing transaction costs, enabling interconnection and cooperation between enterprises, and accelerating innovation processes (OECD, 2000). It is in this perspective that some studies focus on analyzing how ICTs contribute to, impact on, or are a means of generating innovations in service sectors such as finance, education, health, or business development (Añón, 2011; Ollo-López and Aramendía-Muneta, 2012; Lechman and Marszk, 2015; Andreassen, Kjekshus, and Tjora, 2015; Pavela, Fruthb and Neacsu, 2015). In other cases, the role of ICTs in the use and efficiency of innovation processes has been studied: Kroh, Luetjen, Globocnik, and Schultz (2018). For their part, Yunis, El-Kassar and Tarhini (2017) analyze the impact of ICT-based innovations on the performance of the organization.

The services sector has become one of the main creators of wealth and its growth has been very relevant in recent decades, reaching 71% of the Gross Domestic Product worldwide in 2014. In the most advanced economies, services generate up to three quarters of the wealth

and 85% of employment, which increases the demand for understanding the key elements of innovation management in this type of organizations (Tidd and Bessant, 2009; Goffin and Mitchell, 2010). In Costa Rica, the Central Bank revealed that the service sector went from representing 10% of the production of the country in 1966, to 28% in 1991, and 40% in 2012, becoming one of the most important activities.

In the case of ICTs, this sector represented 5.5% of the total added value of the OECD countries in 2013, which is equal to approximately 2.4 trillion dollars. Computer, electronic and optical products and software publishing represented 1.4% and 0.3% of the total added value, respectively, generating a total of 2.6 million jobs (OECD, 2015). Similarly, between 1995 and 2014, world exports of computer and information services grew at a much faster rate than other service sectors, with an average annual growth rate of 18%. According to the Central Bank of Costa Rica (2018), by 2016 Costa Rica exported 3.31 billion USD worth of ICT services, equivalent to 5.8% of Gross Domestic Product (GDP). This percentage is similar to that generated by agricultural activity in the country. Of the total value exported, 88% corresponds to large companies, although there is also a significant participation of microenterprises (7%). The remaining 5% is shared between medium and small enterprises. As for the destination of exports, 60% goes to the United States of America, 13% to Europe, and 12% to Central America.

These data show that companies in the ICT sector have had a very relevant boost in recent decades. This industry is characterized by having a highly changing dynamic. The environment in which they operate, driven by the accelerated advance of technology, knowledge, and client requirements, forces them to seek value added models, this makes it essential to know how companies innovate and how they manage processes. There are studies that analyze how innovation is carried out in the ICT sector: Lee, C., Hyun, J. and Lee, D., 2017; and in some of its sub-sectors, for example in software Yigitcanlar, T. *et al.* (2018), and in business services innovation based on the cloud Ali, Warren, and Mathiassen (2017).

Knowledge Intensive Business Services (KIBS) are considered a cornerstone of contemporary developed economies, Mustak, M. (2017). In the specific case of ICT service companies, these are framed in what are called knowledge-intensive enterprises (KIBS) Figueiredo, Vieira, Gonçalves, and de Matos (2017). In general terms, this type of companies depends to a great extent on professional knowledge, as they use the knowledge to produce intermediate services for the production processes of their clients (Torrosi, 1998).

The objective of this study is to analyze the innovation management process in companies in the ICT sector, which are within the framework of innovation in the digital economy context, focusing especially on the co-creation activities. This article is organized in the following manner: section 2 shows a review of the theoretical considerations on innovation in services and co-creation; section 3 presents the proposal of a model that allows analyzing the management of innovation through different phases; and section 4 describes the main results of the study. Finally, section 5 shows the main conclusions and limitations of the study.

Review of the literature

The services sector is a very diversified part of the economy that comprises intensive technologic and knowledge sectors, as well as information or business services and services with little technology and with few qualifications as the majority of personal services (COTEC,

2004). The service is usually interactive, with a high level of participation and contact among the service providers and clients in the design, production, supply, consumption, and other phases of the activity (Miles, 2005). It is a set of activities and communication actions, linked through partial or full sequences that are simultaneously carried out by the client and the service provider, and its suppliers, to change the state of the client, of an object that the client is interested in or that the client owns, with a purpose in a specific cultural environment (D'Alvano e Hidalgo, 2011). Different authors refer to the main characteristics of the services: intangibility, heterogeneity, and inseparability (Lovelock, 1983; Parasuraman, Zeithaml and Berry, 1985; Kotler, 1997; Miles, 2008; Tidd and Bessant, 2009; Goffin and Mitchell, 2010).

Innovation in services

The concept of innovation is defined as “*the introduction of a new product (good or service) or of one that is significantly improved, a recent process, a new marketing method, or a modern organizational system in the internal practices of a company, the organization of the work place, or if applied to external relations*” (OECD, 2005). From the perspective of Hidalgo *et al.* (2002), innovation is a dynamic process of the efficient use of the knowledge of an organization to develop new or improved products in a different manner. For its part, innovation in the service sector comprises new services and new manners of production or service provision, as well as significant changes in the services, their production, and the manner in which they are delivered. According to Den Hertog *et al.* (2010), it is “*a new service experience or service solution that may involve a new service, a new portfolio of services, and/or a new service process that individually or together define a new way of creating value for the client*”.

Despite the importance of service innovation, the concept is constantly evolving. In this sense, Witell *et al.* analyze and characterize innovation in services according to three different perspectives: assimilation, demarcation, and synthesis. Similarly, Snyder *et al.* (2016), based on an extensive and systematic review of 1,046 academic articles, explored how researchers define and use service innovation. To this end, they identify four unique categories of service innovation that emphasize the following traits: 1) degree of change, 2) exchange rate, 3) novelty, and 4) means of provision.

Traditionally, innovation management and models for its analysis have been subscribed to technological innovation and the manufacturing industry (Gallouj and Weisten, 1997; Chesbrough, 2011). For Tidd and Bessant (2009), most simply assume that such practices are equally applicable to the management of innovation in services; however, some researchers argue that services are fundamentally different. Nevertheless, the growing importance of services in global growth indices has meant that this is currently one of the priority topics of study between different disciplines related to innovation (Miles, 2005; Tidd and Bessant, 2009; Goffin and Mitchell, 2010). These last two authors consider that the very characteristics of services have a direct implication in innovation management, while Chesbrough (2011) argues that the increase in services in this new stage causes these approaches to change if companies want to be successful and sustainable over time.

The process of innovation and co-creation

The service innovation process involves a high degree of interactivity between the service provider and the client (Zeithaml and Bitner, 2003). From the perspective of Markovic and Bagherzadeh (2018) co-creation can generate a multitude of organizational advantages, including improved innovation performance. The participation of different actors in the co-creation of services and in innovation processes has been referenced by authors such as Chesbrough (2003 and 2011), who emphasizes the importance of external agents for innovation in their approaches to open innovation. Other authors refer to co-creation for value addition, innovation, and client participation (Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2008; Tanev *et al.*, 2010; Mele, Russo and Colurcio, 2010; Grönroos, 2011; Mukhat, Nazul and Yahya, 2012; Von Bischoffshausen, Hottum and Straub, 2015, Raeisi and Lingjie, 2017, Cui, and Wu, 2017, Anning-Dorson, 2018, Mahmoud, Hinson and Anim, 2018, Cui and Wu, 2018).

In particular, Greer, Lusch, and Vargo (2016) pose five axioms that characterize this theory: first, service is the fundamental basis of exchange; second, value is co-created by multiple actors, always including the beneficiary; third, all social and economic actors are resource integrators; fourth, value is always determined uniquely and phenomenologically by the beneficiary; and fifth, co-creation is coordinated through institutions and institutional arrangements generated by actors. Lastly, different approaches can be distinguished on the issue of value creation and its relation to co-creation, including S-D logic, service science (Maglio and Spohrer, 2008), service logic, many-to-many marketing, social constructionism, and new product development or postmodernism (Saarijärvi and Hannu, 2013). Vargo, S. and Lusch, R. (2016 and 2017) have incorporated an extension or update of the dominant logic theory of service and argue that it may continue to advance over the next decade towards the further development of a general theory of the market and, even more broadly, towards a general theory of value co-creation.

Methodological aspects

Model proposal

To analyze how ICT companies manage their innovation process, a model based on the TEMAGUIDE model is proposed, elaborated by the COTEC Foundation and which incorporates a series of modules with their corresponding tools that the companies can use in the management of the innovation process (GI_TICmodel). Although this model was initially conceived for the manufacturing industry, several approximations have subsequently been carried out in order to use it in the services sector (COTECT, 2004; D'alvano and Hidalgo, 2011). From this model, the areas of surveillance, learning, and implementation are maintained, and the aspects of strategy are grouped in the focus stage.

In order to identify the singularities presented by companies in the ICT services sector, two new areas have been incorporated into the model: human resources and co-creation. In the area of human resources, based on the approaches of Arzola and Mejías (2007), the importance of knowledge in this sector and the need to incorporate training mechanisms are included. The co-creation area tries to take into account the perspective in which the different actors (clients, suppliers, universities) can actively participate in the processes of value creation and innovation. The analysis of aspects such as project development strategies and the participation

of actors at different stages (ideation, product development, and implementation), the role of clients in the co-creation process (Von Bischhoffshausen, Hottum and Straub, 2015), and the techniques used to carry out co-creation activities (Mukhat, Nazul and Yahya, 2012) are of special interests. Figure 1 represents the proposed model.

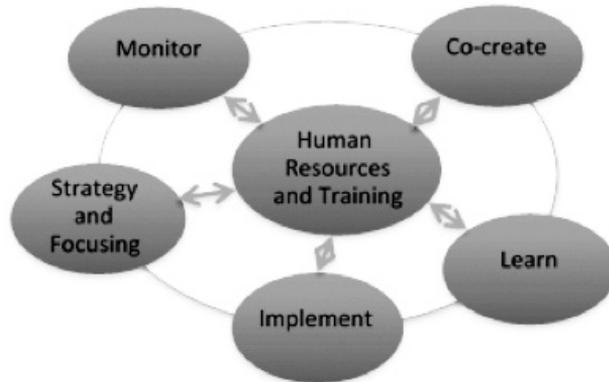


Figure 1. Management model of innovation in ICT services.

Definition of the sample and variables

For the validation of the GI_TIC model, a questionnaire based on contrasted studies was elaborated. For the human resources, monitoring, focusing, implementing, and learning phases, the TEMAGUIDE model (COTEC, 2004) and the questionnaire used by D'Alvano and Hidalgo (2012) were considered but applied to the ICT sector. Pikkarainen et al. (2011) and Von Bischhoffshausen, Hottum, and Straub (2015) were used for the co-creation phase and the project strategy phase. The questionnaire was structured in seven modules with a total of 37 questions, the first of them on general company information (7) and the remaining six correspond to the phases of the model: Human Resources (6), Co-creation (6), Monitoring (4), Strategy and Focusing (6), Implementation (5), and Learning (3).

The survey was applied to managers of companies in the ICT sector in Costa Rica between June and August 2016. Initially, the total population to study was made up of 170 companies associated with the Chamber of Information and Communication Technologies in Costa Rica (CAMTIC), although after a pre-selection a total of 140 companies from the subsectors of information technology, technology commercialization, software development, e-commerce, digital multimedia, digital technology enabled services, and games were consolidated.

The questionnaire was sent using an electronic platform (e-survey) and the response of 47 companies (33.6% of the total) was obtained, classified in the following manner: 19 were from the subsector of information technologies (36.2%), 4 from the e-commerce subsector (8.5%), 2 from the technology commercialization subsector (4.3%), and 5 from the subsector considered as 'others' which includes videogames, augmented and virtual reality, regulation of ICT, and information security (10.6%). The data were processed in SPSS (version 19) and some of the

graphs were from the R program version 3.3.1. Cronbach's alpha was determined with a value of 0.877, which evidences the existence of a proper internal consistence between the variables.

ICT services innovation management index

In order to analyze the innovation capacity of the companies studied, the innovation management index in ICT services (IGIS_TIC) was defined, which is an indicator of the innovation process that companies carry out according to the model presented. This indicator varies from 0 to 100 averaging the score in the sub-index of each phase. The simple average of the sub-indices of each of the phases of the model is obtained: human resources, co-creation, monitoring, strategy and focusing, implementation, and learning (Table 1).

Table 1
 Variables and definition of sub-indices.

INDEX	ACRONYM	VARIABLES USED	DEFINITION
HUMAN RESOURCES	I_DRH	Knowledge acquisition activities (9)	There was a simple index that averaged 3 variables related to the role of Human Resources for companies.
		Innovation management tools have helped in the training of the staff (8)	
		Relevance of human resources for innovation (5)	
CO-CREATE	IC_OC	Phases of the project, according to strategy and actors co-create in the development of the project (9 and 3 actors)	An index was calculated (simple or unweighted) of 2 variables related to the Co-creation carried out by companies according to the strategies used and the actors.
		Techniques for carrying out co-creation activities, according to actors (10)	
MONITORING	I_V	Monitoring activities (8)	An index (simple or unweighted) of 3 variables of the Monitoring phase was calculated.
		Information sources activities (9)	
		Monitoring tools (10)	
FOCUSING	I_F	Strategy and innovation (3)	An index (simple or unweighted) of 6 variables of the Focusing phase was calculated.
		R&D activities in the last 3 years (8)	
		Participation of innovation co-creation actors (6)	
		Ideas selection process (6)	
		Activities to generate ideas (6)	
IMPLEMENTATION	I_I	Tools for the selection of ideas (9)	An index (simple or unweighted) of 4 variables of the Implementation phase was calculated.
		Project development strategy (4)	
		Innovation Project planning strategies (9)	
		Tools to implement innovation (10)	
LEARNING	I_A	Reasons for the development of innovation processes (11)	An index (simple or unweighted) of 2 variables of the learning phase was calculated.
		Company learning activities (4)	
		Enterprise learning tools (7)	

Note: the content in (), column 3, refers to the number of actions or items used in each analysis variable.
 Source: own elaboration based on the Innovation Management Survey in the ICT sector. Costa Rica, 2016.

After creating the sub-indices, the IGIS_TIC index is obtained with their average (human resources, co-create, monitoring, focusing, implementation, and learning), the formula of which is:

$$IGIS_TIC = \frac{\sum_{i=1}^6 \bar{F}_i}{6}, \quad \text{donde} \quad \bar{F}_i = \frac{\sum_{j=1}^n v_{ij}}{n};$$

Correlations between general index and sub-indices

Figure 2 presents the matrix of correlations between the ICT services innovation management index (IGIS_TIC) and the sub-indices that make up the model. The results show that all the correlations are significant with respect to the IGIS_TIC, in all cases with a value greater than 0.7. The relations are direct and positive, which means that when the value of a certain index increases the other increases, which allows indicating and justifying the use of the indices for the development of the IGIS_TIC. In addition, it is important to point out that there are also positive relationships between the sub-indices.

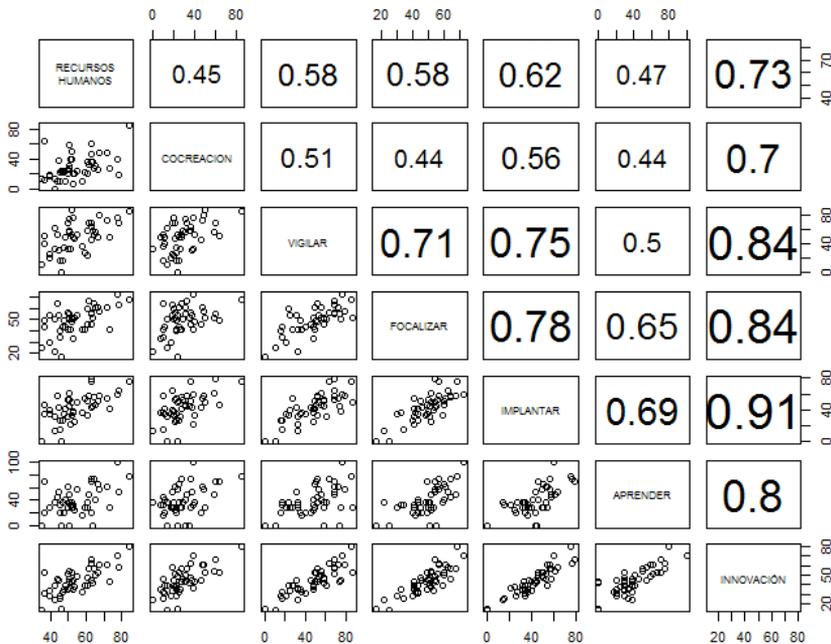


Figure 2. Correlation matrix of the model
 Source: own elaboration based on the Innovation Management Survey of the ICT sector, Costa Rica. 2016.

Co-create, clients, partners-suppliers, and universities indices

The co-create index (I_COC) is obtained from the simple average of two variables, one of which results from the combination of nine possible co-creation options for each actor, derived from the three strategies and the three phases of the project execution. Also considered for the calculation was the sum of ten co-creation techniques used by companies. The mathematical definition of the index is:

$$I_COC = \frac{\sum_{i=1}^m v(t)_i}{m}$$

Additionally, three sub-indices are generated: clients (I-CL), partner-suppliers (I_SP), and universities (I-UNIV), which are calculated in the same way as co-creation with the difference that in these cases each sub-index refers to the actors selected for this study (client, partners and suppliers, universities).

In order to analyze the significance of these sub-indices, a multiple regression was developed in relation to the innovation index (dependent variable). As a result, it was obtained that all the variables analyzed give significance to 0.1, with the value of the R² adjustment being 0.449 and the Durbin-Watson statistic being 1.939.

Coefficients*					
Model B	Non-standardized models		Standard coefficients	t	Sig.
	Standar error	Beta			
(Constant)	27.102	3.365		8.055	.000
CLIENT_INDEX	.215	.065	.384	3.289	.002
PARTNERS_INDEX	.176	.049	.410	3.592	.001
UNIVERSITIES_INDEX	.183	.103	.205	1.770	.084

a. Dependent variable: INNOVATION INDEX

Figure 3 presents the matrix of correlations between the IGIS_TIC with the sub-indices I_COC, I_CL, I_SP, and I_UNIV. The results show that all the correlations are significant, that there are direct and positive relations with respect to the I_COC, and that the sub-indices of clients and suppliers have a value equal to or greater than 0.7, while in the case of universities the sub-index is lower (0.5). Nevertheless, the sub-indices with respect to the IGIS_TIC are positive, although their values are lower than 0.5. It is important to note that the relations between the actors are very low, which is not significant in the analysis since what is studied is the relationship of the company with the actors and not how they interact with each other.

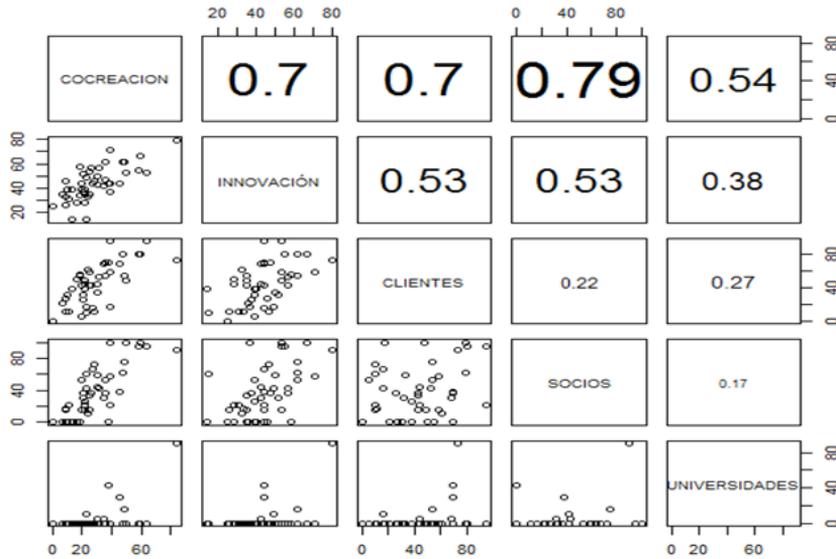


Figure 3. Matrix of correlations between co-creation and innovation management

Source: own elaboration based on the Innovation Management Survey of the ICT sector. Costa Rica, 2016.

Main results

Once the study variables, the GIS_ICT index, and the corresponding sub-indices and their correlations have been defined, the analysis focused on identifying the process of co-creation within innovation management using the variables “number of employees” and “subsector” to which the companies belong. Regarding the matter of co-creation, the participation of the actors according to the strategy of the company and the different phases of the project, the role of the client, and the most used tools in the co-creation phase were specifically analyzed.

Characteristics of the company

According to Pavitt (1984), sectors have different priorities and characteristics that condition companies by the effects of innovation, economies of scale, and scientific intensity. With respect to size, Rothwell (1985) points out that this is a factor that has special repercussions in terms of access to resources and other factors. The use of these variables is reinforced by Tidd and Bessant (2009), who add that these aspects may affect the management of innovation in companies.

Figure 4 shows the average value of the IGIS_TIC index and of the sub-indices that represent the capacity for co-creation. It is observed that when companies have fewer employees, i.e., between 1 and 30, the average value of the general innovation management index is below the average. This situation is the opposite when companies have more than 30 employees, which allows to conclude that the larger the company, the better its innovation management index. This scenario changes when analyzing the sub-indices related to co-creation, given that, with

the exception of companies with 11 to 30 employees, in the client sub-index the average value is higher than the average, and only large companies (with more than 100 employees) have average values in the sub-indices higher than the overall average. As a complement to the above, after doing a multiple regression, taking as a dependent variable the IGIS_TIC and the variables “subsector” and “number of employees”, the data indicate that only the number of employees is significant, that is, for each employee that has a company the IGIS_TIC increases by 0.363 points.

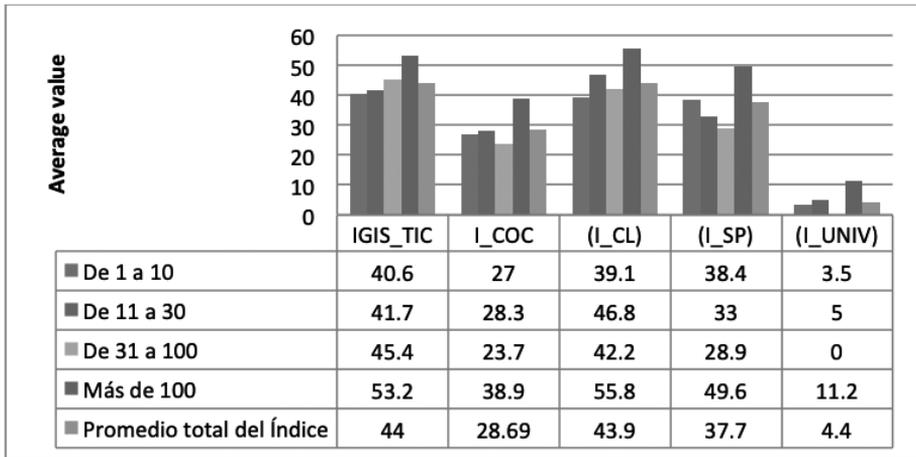


Figure 4. Average value of the indices (IGIS_TIC and I_COC) and sub-indices (I_CL, I_SP and I_UNIV) according to the size of the company
 Source: own elaboration based on the Innovation Management Survey of the ICT sector. Costa Rica, 2016.

Subsector

When analyzing the subsector to which the company belongs, the results allow to identify that when companies belong to the software development and technology commercialization subsectors they have average values lower than the general average of the respective sub-index. When co-creation occurs with clients, the respective sub-index is greater than the average value for IT and e-commerce companies than when it occurs with suppliers and universities. Although in some subsectors the sub-indices of co-creation and actors are below average, this situation is more favorable when analyzing the general innovation index IGIS_TIC. In this case, only technology commercialization companies have a value lower than the general average (Figure 5).

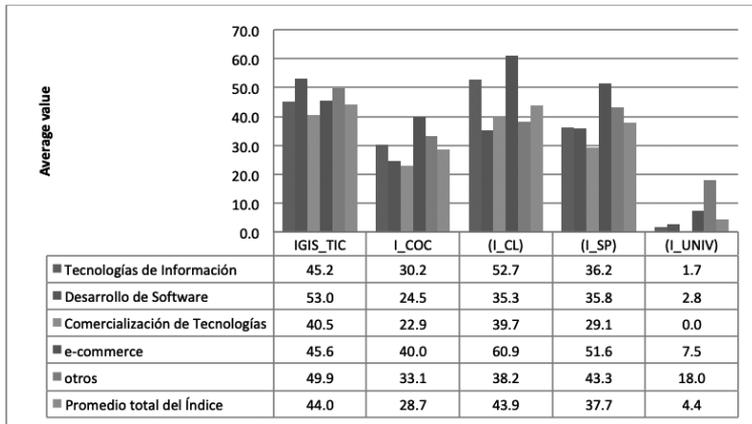


Figure 5. Average value of the indices (IGIS_TIC and I_COC) and the sub-indices (I_CL, I_SP and I_UNIV) according to the subsector.

Source: own elaboration based on the Innovation Management Survey of the ICT sector. Costa Rica, 2016.

Actors and their relation with the type of strategy

When analyzing how the indices related to co-creation and actors behave, and their relationship with the type of strategy for project development, the companies participating in the study that use each of the strategies in the vast majority of cases have indices with values higher than the average (Table 2). It is highlighted that those who use strategy have higher values in each sub-index than those who do not use it, which indicates that the companies that implement these strategies have more efficient innovation processes.

Table 2

Average value of the 'co-creation' and 'actors' sub-indices according to the strategy.

STRATEGY/INDEX	I_COC	I-CL	I-SP	I-UNIV
Development strategy based on projects				
NO	12.4	20.1	16.9	0.0
YES	32.7	49.8	42.9	5.5
Out-of-the-box strategy for the development of products				
NO	19.3	34.3	23.7	0.0
YES	33.8	49.1	45.4	6.8
Tailor-made product development strategy				
NO	20.3	31.1	28.2	1.7
YES	31.7	48.5	41.1	5.4
TOTAL	28.69	43.9	37.7	4.4

Source: own elaboration based on the Innovation Management Survey of the ICT sector. Costa Rica, 2016.

Actors and their participation in the stages of the project

The analysis of the participation of actors in the project development stages (devising, project development, implementation, and adaptation) shows that in companies that use the “project-based” strategy, clients are involved in both the devising and implementation phases. This situation varies when collaborating with partners and suppliers, where their greatest participation occurs at the product development phase. This behavior is the same as when the actor is the university (Figure 6).

In companies that use the “out-the-box” strategy there is greater client participation in the devising and implementation phases. When collaboration takes place with partners and suppliers there is greater participation and, in the same percentage, in the devising and product development phases. For the university actor the greatest participation occurs in the development phase.

In those companies that use the “custom product development” strategy there is greater client participation in the devising and the implementation phases. When the collaboration is with the supplier-partners and with the university there is greater participation in the product development phase.

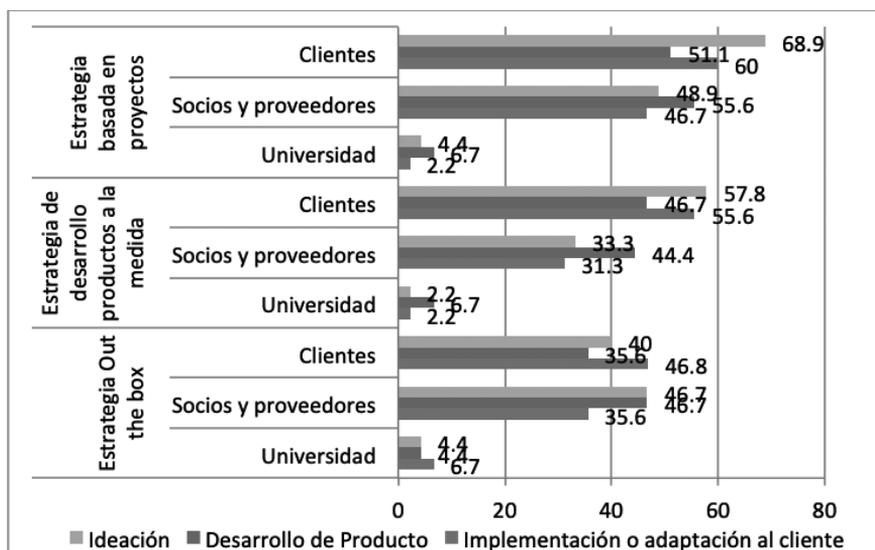


Figure 6. Participation of the actors in the development phase of projects according to strategy.
 Source: own elaboration based on the Innovation Management Survey of the ICT sector. Costa Rica, 2016.

The role of the client in co-creation

According to the perspective put forward by Von Bischhoffshausen, Hottum, and Straub (2015), clients may have different roles in the co-creation process. It is interesting to know the values obtained by analyzing the roles of the clients with respect to the innovation and co-creation indices and the client sub-index. As can be observed in Table 3, for all client roles the

innovation index is higher than the average. On the other hand, when the client acts as a service specifier and quality auditor, the co-creation index is lower than the average. For the client sub-index, when the client acts as a quality auditor, it decreases in relation to the average. The fact that when a certain function or technique is used it is higher than the average is due to the fact that it has a higher value than those who do not use it.

Table 3

Average value of the co-create index and the client sub-index according to the role of the client.

Role of the client	I_COOC		I_CL		IGIS_TIC	
	YES	NO	YES	NO	YES	NO
Co-designer: assists as a “consultant” during the design and decision-making process.	33.6	23.4	49.8	37.7	46.5	41.3
Service Specifier: projects the delivery service through its specification	27.0	32.0	45.8	40.0	44.4	43.0
Co-marketer: supports service marketing through word-of-mouth advertising.	32.0	28.0	49.5	42.8	51.9	42.5
Quality auditor: assures the quality of production and delivery through open testing and complaints.	28.3	29.0	43.3	44.5	45.4	42.3
Co-producer: Provides input in the form of production factors: work, knowledge, information.	38.1	22.3	55.2	36.3	48.4	41.0
TOTAL	28.6		43.9		44.0	

Source: own elaboration based on the Innovation Management Survey of the ICT sector. Costa Rica, 2016.

Use of techniques and tools

The use of management techniques and tools are relevant in studies related to innovation and has been considered an important factor for the success of innovation management (Hidalgo and Albors, 2008; Igartua, Albors, and Hervás, 2010; Teza *et al.*, 2016, Harrington and Voehl, 2016; Albors, Igartua, and Peiro, 2018). For their part, D’Alvano and Hidalgo (2012) apply innovation management techniques to study the degree of development of the innovation process in service organizations (trade, health, and education). Albors, J., Igartua, J., and Peiro, A. (2018) analyze how the use of Innovation Management Techniques (IMTS) influences the innovation performance of enterprises. In the field of tools related to innovation and co-creation, Fuller *et al.* (2009) study how consumer empowerment is through Internet-based co-creation; for their part, Pallot *et al.* (2010) study the use of Living Lab in research environments, from user-centered design and their experience in co-creation; while Kohler *et al.* (2011) analyze the consequences of the virtual co-creation experience and the use of avatars as an opportunity for companies to take advantage of the innovative potential of consumers and consumer communities.

In the study, companies were consulted about which tools are more or less used, according to the type of actor they are related to in the innovation and co-creation processes. As shown in Figure 7, the tools used are not homogeneous for the three actors and the degree of use varies according to the type of actor. However, the participatory methods tools (focus group, idea boxes, and empathic design) obtain the highest percentages of use regardless of the type of actor. When companies co-create with clients, the tool co-design and use of artefacts and prototypes is relevant (51.1%), while with the supplier actor the use of digital media is important

(46.7%). In the case of the university, the methods of innovation based on user communities are among the most used. On the contrary, tools such as “Living Lab” and “people and avatars” are not widely used. The use of digital media tends to be greater when working with partners and suppliers.

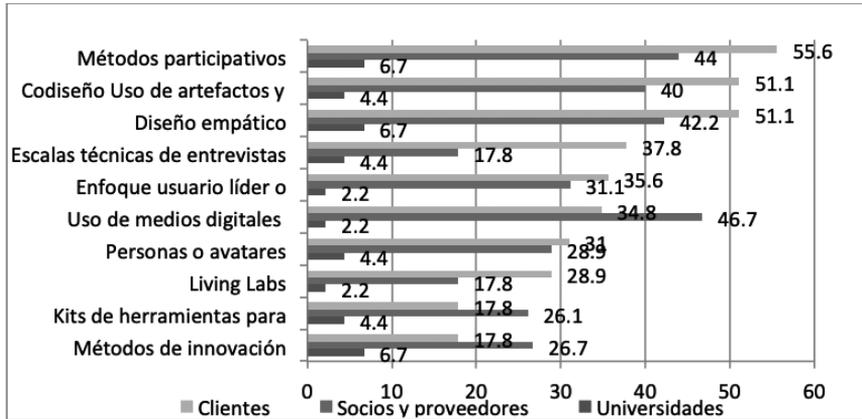


Figure 7. Percentage of the use of co-creation tools according to actor.
 Source: own elaboration based on the Innovation Management Survey of the ICT sector. Costa Rica, 2016.

Conclusions

In the economic domain, the service sector has grown exponentially for several decades, becoming in some countries the main source of income for the economy. For its part, the ICT revolution has led to a productive transformation; and interconnected networks and the globalization of knowledge and business have expanded the access of clients and users to goods and services. Moreover, actors are no longer simply buyers, rather they have become sources and generators of ideas for innovation and can participate in different phases of projects.

These facts have allowed an important growth of companies in the ICT sector, which play a relevant role from two points of view: as generators of goods and services, and as a source for other sectors of the economy to accelerate their innovation processes and improve the services they provide to consumers. From this perspective, ICT companies face the challenge of increasing their capacity to differentiate and add value through innovation and, therefore, the implementation of their management processes, in order to guarantee high quality services to their clients in accordance with user needs. Adding value requires co-creation processes involving different actors.

As a result of this study, the following aspects can be mentioned as being of special relevance:

- The proposed model of innovation management in ICT service companies is significantly suited to service companies.
- The size of the company continues to be an important factor for companies to increase their innovation management capacity, i.e., the larger the innovation management index

the more the sub-indices related to co-creation tend to increase. Size also influences the participation of different actors, for example, when companies are larger, they co-create more with universities.

- Even though it is assumed that clients are the main actors in the co-creation process, the results of the study show that partners and suppliers play a significant role in this process. However, the low level of participation of universities in the co-creation process should be highlighted. One of the possible reasons for this is that companies in the ICT sector—since they are knowledge-intensive as they have highly qualified professionals and due to the type of services they provide—can carry out their innovation processes internally or with the support of clients and suppliers. However, in this aspect, it is important to conduct more research and see if this behavior occurs in the same way in other less knowledge-intensive sectors.

- The participation of actors in the different phases of project development varies according to the type of strategy they use and the type of stakeholder. For example, in project-based strategy, clients are more actively involved in the ideation and implementation phases, although in the case of partners and suppliers they are more involved in the development phase.

- The use of tools for co-creation varies depending on the type of actor, that is, there is no homogeneity in the type of tool that is used by each type of actor.

- In a context of intensification of globalization processes, where the demands of competitiveness are increasing, a response to generate greater added value to products and services, aimed at both external and local markets, is to increase activities related to innovation management and joint work with different actors in ICT service companies, in order to improve their processes of innovation and value addition, especially in small and medium enterprises.

References

- Albors, J., Igartua, J. y Peiro, A. (2018). Innovation management techniques and tools: its impact on firm innovation performance. *International Journal of Innovation Management*, 22(6). <https://doi.org/10.1142/s1363919618500512>.
- Ali, A., Warren, D. and Mathiassen, Lars (2017). Cloud-based business services innovation: A risk management model. *International Journal of Information Management*. 37 (6), 639-649. <https://doi.org/10.1016/j.ijinfomgt.2017.05.008>.
- Andreassen, H., Kjekshus, L., Tjora, A. (2015). Survival of the project: A case study of ICT innovation in health care. *Social Science & Medicine*, 132, 62-69. <https://doi.org/10.1016/j.socscimed.2015.03.016>
- Anning-Dorson, Thomas (2018). Customer involvement capability and service firm performance: The mediating role of innovation. *Journal of Business Research*, 86, 269-280. <https://doi.org/10.1016/j.jbusres.2017.07.015>
- Añón, D. (2011). The impact of ICT on innovation activities: Evidence for UK SMEs, *International Small Business Journal* 30(6), 684–699. <https://doi.org/10.1177/0266242610374484>
- Arzola, M., Mejías A. (2007). Modelo conceptual para gestionar la innovación en empresas del sector servicios. *Revista Venezolana de Gerencia* 12(37), 80-98. Disponible en: <http://www.redalyc.org/articulo.oa?id=29003706>. Consultado: 14/10/2016
- Banco Central de Costa Rica (2018). Resultados del Estudio: Exportaciones de servicios por medio de las Redes TIC. Mayo, 2018. https://activos.bccr.fi.cr/sitios/bccr/ComunicadosPrensa/Docs_Comunicados_Prensa/ICT_Project_CR_ESP.pdf
- Castells, M. (2001). *La Era de la Información*. Siglo XXI Editores. México.

- Chesbrough, H. (2003). *Open innovation: the new imperative for creating and profiting from technology*. Harvard Business School Press. Boston, Mass.
- Chesbrough, H. (2011). *Open Services Innovation. Rethinking Your Business to Grow and Compete in a New Era*. HB Printing. EE.UU.
- COTEC (2004). *Análisis del proceso de innovación en las empresas de servicios*. Madrid, España.
- Cui, A. and Wu, F. (2017). The Impact of Customer Involvement on New Product Development: Contingent and Substitutive Effects. *Journal of Product Innovation Management*, 34, 1, (60-80). <https://doi.org/10.1111/jpim.12326>
- Cui, A. and Wu, F. (2018). Customer Involvement in Innovation: A Review of Literature and Future Research Directions, in Rajan Varadarajan, Satish Jayachandran. (ed.) *Innovation and Strategy* (Review of Marketing Research, Volume 15) Emerald Publishing Limited, pp.63 – 98. <https://doi.org/10.1108/s1548-643520180000015005>
- D'Alvano, L., Hidalgo, A., (2011). Procesos de innovación en las organizaciones de salud y educación en Venezuela. *Revista Venezolana de Gerencia* 16(56), 578-594. Disponible en: <http://www.redalyc.org/articulo.oa?id=29020563005>. Consultado: 17/10/2016
- D'Alvano, L., Hidalgo, A. (2012). Innovation management techniques and development degree of innovation process in service organizations. *R&D Management* 42(1), 60-70. <https://doi.org/10.1111/j.1467-9310.2011.00663.x>
- Den Hertog, P., de Aa, W., de Jong, M. (2010). Capabilities for managing service innovation: towards a conceptual framework. *Journal of Service Management* 21(4), 490-514. <https://doi.org/10.1108/09564231011066123>
- Elkelsen, G., Marcus, A., Ferree, W.K. (2009). *The digital economy fact book 2008-2009. The Progress & Freedom Foundation. Washington D.C.* Disponible en: <http://www.pff.org/digital-economy-fact-book/>. Consultado: 14/9/2016
- Figueiredo, R., Vieira, J., Gonçalves, O. y De Matos, J. (2017). Knowledge Intensive Business Services (KIBS): bibliometric analysis and their different behaviors in the scientific literature Topic 16 – Innovation and services. *RAI Revista de Administração e Inovação* 14 (2017) 216–225. <https://doi.org/10.1016/j.rai.2017.05.004>
- Füller, J., Mühlbacher, H., Matzler, K., Jawecki, G. (2009). Consumer empowerment through internet-based co-creation. *Journal of Management Information Systems* 26(3), 71–102. <https://doi.org/10.2753/mis0742-1222260303>
- Fundación EOI (2010). *Economía Digital. Serie Sectores de la nueva Economía 20+20*. Madrid, España. Disponible en: <http://www.eoi.es/blogs/20digital/>. Consultado: 14/9/2016
- Gallouj, F., Weinstein, O. (1997). Innovation in services. *Research Policy* 26, 537-556. [https://doi.org/10.1016/S0048-7333\(97\)00030-9](https://doi.org/10.1016/S0048-7333(97)00030-9)
- Goffin, K., Mitchell, R. (2010). *Innovation Management. Strategy and implementation using the pentathlon framework*. Palgrave Macmillan. Second edition. <https://doi.org/10.1007/978-1-137-04752-6>
- Greer, C., Lusch, R., Vargo, S. (2016). A service perspective: Key managerial insights from service-dominant (S-D) logic. *Organizational Dynamics* 45, 28-38. <https://doi.org/10.1016/j.orgdyn.2015.12.004>
- Grönroos, C. (2011). Value co-creation in service logic: A critical analysis. *Marketing Theory* 11(3), 279–301. <https://doi.org/10.1177/1470593111408177>
- Hidalgo, A., León, G., Pavón, J. (2002). *La Gestión de la Innovación y la Tecnología en las Organizaciones*. Pirámide. Madrid.
- Hidalgo, A., Albors, J. (2008). Innovation management techniques and tools: A review from theory and practice. *R&D Management*, 38(2), 113–127. <https://doi.org/10.1111/j.1467-9310.2008.00503.x>
- Igartua, J., Albors, J., Hervás-Oliver, J. (2010). How innovation management techniques support an open innovation strategy. *Research-Technology Management* 53(3). <https://doi.org/10.1080/08956308.2010.11657630>
- Harrington, J. (Editor) and Voehl, F. (Editor), (2016). *The Innovation Tools Handbook, Volume 3: Creative Tools, Methods, and Techniques that Every Innovator Must Know*. ISBN-13: 978-1498760539, 1st Edition. <https://doi.org/10.1201/9781315367682>
- Kohler, T., Fueller, J., Stieger, D., Matzler, K. (2011). Avatar-based innovation: Consequences of the virtual co-creation experience. *Computers in Human Behavior* 27, 160–168. <https://doi.org/10.1109/hicss.2010.78>
- Kotler, P. (1997). *Mercadotecnia*. Prentice-Hall. México.
- Kroh, J., Luetjen, H., Globocnik, D., and Schultz, C. (2018). Use and Efficacy of Information Technology in Innovation Processes: The Specific Role of Servitization. *Journal of Product Innovation Management* (in press). <https://doi.org/10.1111/jpim.12445>.

- Lechman, E., Marszk, A. (2015). ICT technologies and financial innovations: The case of exchange traded funds in Brazil, Japan, Mexico, South Korea and the United States. *Technological Forecasting & Social Change* 99, 355–376. <https://doi.org/10.1016/j.techfore.2015.01.006>
- Lee, C., Hyun, J. and Lee, D., (2017). Intra-industry innovation, spillovers, and industry evolution: Evidence from the Korean ICT industry. *Telematics and Informatics* 34 (2017) 1503–1513. <https://doi.org/10.1016/j.tele.2017.06.013>
- Lovelock, C. H. (1983). Classifying services to gain strategic marketing insights. *Journal of Marketing* 47, 9-20. Classifying services to gain strategic marketing insights. <https://doi.org/10.2307/1251193>
- Mele, C., Russo, T., Colurcio, M. (2010). Co-creating value innovation through resource integration. *International Journal of Quality and Service Sciences*, 2(1), 60-78. <https://doi.org/10.1108/17566691011026603>
- Maglio, P.P., Spohrer, J. (2008). Fundamentals of service science. *Journal of the Academy of Marketing Science*, 36(1), 18-20. <https://doi.org/1007/s11747-007-0058-9>
- Mahmoud, M., Hinson, R., and Anim, P. (2018). “Service innovation and customer satisfaction: the role of customer value creation”, *European Journal of Innovation Management*, 21 (3), 402-422, <https://doi.org/10.1108/EJIM-09-2017-0117>
- Markovic, S. and Bagherzadeh, M. (2018). How does breadth of external stakeholder co-creation influence innovation performance?. Analyzing the mediating roles of knowledge sharing and product innovation. *Journal of Business Research*, 88, 173-186. <https://doi.org/10.1016/j.jbusres.2018.03.028>
- Miles, I. (2005). *Innovation in Services*. In The Oxford Handbook of Innovation. Edited by Fagerberg, J., Mowery D. and Nelson, R. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199286805.003.0016>
- Miles, I. (2008). Patterns of innovation in service industries. *IBM Systems Journal*, 47(1). <https://doi.org/10.1147/sj.471.0115>
- Mukhat, M. Nazul, M. y Yahya, Y. (2012). A hierarchical classification of co-creation models and techniques to aid in product or service design. *Computers in Industry* 63(4), 289-297. <https://doi.org/10.1016/j.compind.2012.02.012>
- Mustak, M. (2017). Customer participation in knowledge intensive business services: Perceived value outcomes from a dyadic perspective. *Industrial Marketing Management* <http://dx.doi.org/10.1016/j.indmarman.2017.09.017>
- OECD (2000). *Science, Technology and Innovation in the New Economy*. OECD Observer. Paris. Disponible en: <http://www.oecd.org/science/sci-tech/1918259.pdf>. Consultado: 10/11/2016
- OECD (2015). *OECD Digital Economy Outlook 2015*. Paris. Disponible en: <http://www.oecd.org/internet/oecd-digital-economy-outlook-2015-9789264232440-en.htm>. Consultado: 14/10/2016
- Ollo-López, A., Aramendía-Muneta, E. (2012). ICT impact on competitiveness, innovation and environment. *Telematics and Informatics* 29(2), 204–210. <https://doi.org/10.1016/j.tele.2011.08.002>
- Pallot, M., Trousse, B., Senach, B., Scapin, D. (2010). Living Lab Research Landscape: From User Centred Design and User Experience towards User Co-creation. First European Summer School “Living Labs”. Paris. Disponible en: <https://hal.inria.fr/inria-00612632/document>. Consultado: 01/10/2016
- Parasuraman, A., Zeithaml, V., Berry, L. (1985). A conceptual model of service quality and its implications for future research. *Journal of Marketing* 49, 41-50. <https://doi.org/10.2307/1251430>
- Pavela, A., Fruth, A., Neacsu, M. (2015). ICT and e-learning – catalysts for innovation and quality in higher education. *Procedia Economics and Finance* 23, 704-710. [https://doi.org/10.1016/s2212-5671\(15\)00409-8](https://doi.org/10.1016/s2212-5671(15)00409-8)
- Pavitt, K. (1984). «Sectoral Patterns of Technological Change: Towards a Taxonomy and Theory». *Research Policy*, 13, 343-373. [https://doi.org/10.1016/0048-7333\(84\)90018-0](https://doi.org/10.1016/0048-7333(84)90018-0)
- Pikkarainen, M., Codenie, W., Boucart, N., Heredia Alvaro, J.A. (2011). *The Art of Software Innovation. Eight Practice Areas to Inspire your Business*. Springer. <https://doi.org/10.1007/978-3-642-21049-5>.
- Pralhalad, C.K., Ramaswamy, V. (2004). Co-creating unique value with customers. *Strategy and Leadership* 32(3), 4–9. <https://doi.org/10.1108/10878570410699249>.
- Raeesi, S., Lingjie, M., (2017). The Importance of Customer Engagement and Service Innovation in Value Co-Creation. *International Journal of Economics and Management Engineering*. 11 (4). <http://waset.org/pdf/books/?id=62816&pageNumber=97>. Consultado: 19/04/2018
- Rothwell, R. (1985). Reindustrialization and technology: Towards a national policy framework. *Science and Public Policy*, 12 (3), 113–130, <https://doi.org/10.1093/spp/12.3.113>

- Saarijärvi H., Hannu, K. (2013). Value co-creation: theoretical approaches and practical implications. *European Business Review* 25(1), 6-19. <https://doi.org/10.1108/09555341311287718>
- Snyder, H. et al. (2016). Identifying categories of service innovation: A review and synthesis of the literature. *Journal of Business Research* 69 (2016) 2401–2408. <https://doi.org/10.1016/j.jbusres.2016.01.009>
- Tanev, S., Thomsen, M., Zheng, M. (2010). *Value co-creation: From an emerging paradigm to next innovation practices*. Proceedings of the 3rd ISIPM Innovation Symposium. Quebec, Canada. 12-15 December 2010. Disponible en: http://findresearcher.sdu.dk/portal/files/47896977/ISIPM_20010_Paper_Quebec_Canada.pdf. Consultado: 01/10/2016
- Tapscott, D. (1995). *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*. McGraw-Hill.
- Teza, P., Buchele, G., De Souza, J., Dandolini, G. (2016). Analysis of quantitative empirical papers on diffusion and adoption of methods, techniques and tools for innovation. *Revista de Administração e Inovação* 13 (2). <https://doi.org/10.1016/j.rai.2016.03.004>
- Tidd, J., Bessant, J. (2009). *Managing Innovation. Integrating Technological, Market and Organizational Change*. 4th Edition. John Wiley & Sons, Ltd.
- Torrosi, S. (1998). *Industrial Organisation and Innovation. An International Study of the Software Industry*. Edward Elgar, Cheltenham, UK.
- Vargo, S. Maglio, P., Akaka, M. (2008). On value and value co-creation: A service systems and service logic perspective. *European Management Journal* 26, 145-152. <https://doi.org/10.1016/j.emj.2008.04.003>
- Vargo, S., Lusch, R. (2008). Service-dominant logic: Continuing the evolution. *Journal of the Academy of Marketing Sciences* 36,1-10. <https://doi.org/10.1007/s11747-007-0069-6>
- Vargo, S., Lusch, R. (2016). Institutions and axioms: an extension and update of service-dominant logic. *Journal of the Acad. Mark. Sci.* (2016) 44:5–23. <https://doi.org/10.1007/s11747-015-0456-3>.
- Vargo, S., Lusch, R. (2017). Service-dominant logic 2025. *International Journal of Research in Marketing*, 34 (1), 46-67. <https://doi.org/10.1016/j.ijresmar.2016.11.001>
- Von Bischhoffshausen, J., Hottum, P., Straub, T. (2015). *Service co-creation. Part of the series Service Science: Research and Innovations in the Service Economy*, pp 261-296. Springer International Publishing. https://doi.org/10.1007/978-3-319-23195-2_8
- Witell, L. et al. (2016). Defining service innovation: A review and synthesis. *Journal of Business Research*. Volume 69, Issue 8, August 2016, Pages 2863-2872. <https://doi.org/10.1016/j.jbusres.2015.12.055>
- Yigitcanlar, T. et al (2018). Impact of funding sources on innovation: evidence from Brazilian software companies. *R&D Management* (in press) <https://doi.org/10.1111/radm.12323>.
- Yunis, M., El-Kassar, A. and Tarhini, A. (2017). “Impact of ICT-based innovations on organizational performance: The role of corporate entrepreneurship”, *Journal of Enterprise Information Management*, 30 (1), 122-141, <https://doi.org/10.1108/JEIM-01-2016-0040>
- Zeithaml, V., Bitner, M. (2003). *Service Marketing: Integrating Customer Focus across the Firm*. McGraw-Hill. New York.