Service Design Methodologies. A Systematic Literature Review

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Service Design Methodologies

A Systematic Literature Review

Abstract: Problem definition: Services are an important aspect of the economy on a world-wide scale. However, few studies show how they should be designed. Relevance: This study allows to identify and analyze the various existing methodologies that can be used to carry out the service design process. Methodology: We have carried out a systematic literature review on the basis of the guidelines proposed by Kitchenham. We propose five research questions plus six questions to analyse each of the existing proposals, along with six questions to assess their quality. Results: Of the total of 4366 studies found, 287 were considered relevant. 141 of these were considered to be relevant non-duplicated studies, 18 of which eventually became primary studies. These primary studies allowed us to obtain 10 proposals to be analyzed in depth. The study reveals the existence of certain methodologies that could be employed to design services. However, although we were able to identify the existence of new concepts related to the service sector, such as active participation, co-creation, user-orientation, reengineering and customer experience, the application of these concepts is still immature as regards service-design methodologies. Managerial implications: The design of services is a holistic, multidisciplinary and integrating field, composed of different disciplines such as computer science, services, business, etc. Although the impact of this discipline is broad, there is little scientific literature on methodologies for service design, this study aims to show both the academic and business, the advances on this discipline and the possible improvements for future research that can be developed on Service design.

Keywords: Service design   Service innovation   Servitization   Systematic literature review

1 Introduction

Literature provides definitions of the term service, such as the way in which 'organisations wish their services to be perceived by their customers, employees, shareholders and financers' [1] . Other authors define services as 'activities, benefits or satisfactions that are rented or sold, and which are essentially intangible or do not result in the ownership of anything' [2]. For some, services are 'a detailed description of what is to be done for the customer (what needs and wishes are to be satisfied) and how this is to be achieved'[3]. One interesting concept is that of considering services as a mental image, i.e., 'service in the mind' [4], sustained not only by customers, but also by employees and designers. The majority of the aforementioned definitions consider that it is important to satisfy the customer's needs, and for this to happen it is vital that a process of interaction between consumer and producer[5] is carried out, which allows the identification of the value that the service to the customer brings.

It is currently evident that the service (tertiary) sector moves the world's economy, contributing to the nominal Gross Internal Product (GIP) with (68.3%), as opposed to the (27%) of the secondary sector (industry) and the (3.4%) of the primary sector (agriculture) -

data acquired from the World Bank. The service sector has undergone a tremendous growth in the last few years, and it is owing to the impact that the service sector has on the economy that companies are showing an increasing interest in understanding all that is related to this sector.

New concepts have appeared in this context, of which we can highlight Service design, which is an interdisciplinary approach that combines different methods and tools from various disciplines. It is a new way of thinking as opposed to a new stand 'alone academic discipline' [1], and which has also been described as 'a new holistic, multidisciplinary and integrating field' [6]. According to the aforementioned definitions, it could be said that Service design could be used to aggregate value (for both the customer and the company) by integrating various disciplines, which will in turn make it possible to understand the customer's real needs, design a service before it is set in motion or launched, create a prototype and maintain constant feedback with the customer and, as a result of this, produce a better customer experience.

The application of Service design allows organisations to preview how their services are perceived by their customers, employees, shareholders and creditors [7] and they do this with the support of various tools, methods and models. Literature contains various examples of methodological proposals with which to carry out the service design process. It should be mentioned that most of them are either oriented towards product design or have been modified in order to adapt them to the services sector to cope with the recent interest in the sector from the industry. However, even when existing methodologies or proposals do consider interesting concepts and tools, which are useful for services, they still do not fit exactly with the nature of Service design, whose objective is to satisfy customer expectations, and therefore considers the customer to be the main actor and focus of the process. All in all, the need for methodologies focused explicitly on Service design arises.

Therefore, owing to the increasing importance of services and the new scenarios that are appearing in this sector, we have carried out a Systematic Literature Review[8], [9] to identify and analyse existing proposals with which to carry out the Service design process. This will enable us to discover the current state of the art and detect possible room for improvement as regards this theme and some related issues.

The remainder of this document is structured as follows: section 2 provides a description of the method used to carry out the systematic literature review, whose execution is summarized in section 3. The results of the review are then presented in section 4 and later discussed in section 5 . Finally, section 6 summarizes the main conclusions, which reflect what has been discovered by means of the review, the areas for improvement detected and possible directions for future work.

2 Method

The research method employed to carry out this study is a Systematic Literature Review (SLR), using the guidelines provided by Kitchenham and Charters [8], [9] and Biolchini et al. [10] as a basis, which is illustrated Figure 1. According to these guidelines, a systematic literature review is carried out in three stages: planning, execution and analysis of results.

Another stage, denominated as packaging [10], is performed throughout the whole process in order to store the results of the previous stages.

As mentioned before, in thisin this (Section 2), we will focus on the planning stage which involves defining the research objectives and the way the review was carried out. In the following subsections, we will specify therefore the main elements of the plan: research questions (*RQ*) (Section 2.1); data sources and search chains (Section 2.2); inclusion and exclusion criteria (Section 2.3); quality assessment criteria (Section 2.4); data extraction process (Section 2.5) and GPS assessment (Section 2.6)
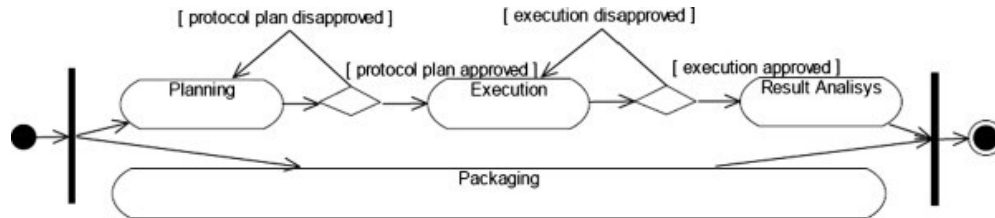

Fig. 1. Systematic Literature Review process proposed by Biolchini

2.1 Research questions

The first step carried out in the planning stage is that of defining the principal objective of the systematic literature review, which in this case is: to identify and analyse existing methodological proposals for service design process. In order to attain this objective, we defined five Research Questions (*RQ*) with which to guide the systematic review process:

• *RQ1*:What methods currently exists to guide service design processes?

Being an interdisciplinary field, service design involves various disciplines, techniques and tools, all of which allow the final result to provide valuable information, which is then used by companies to discover their customers' needs and expectations. This implies that its implementation is complex and costly, which is one of the main reasons for the interest in discovering existing methodological proposals for service design. We are therefore interested in discovering whether there are methodologies covering the whole process; the techniques, tools or models proposed by each of them; their orientation and how easy and effective it is to put them into practice.

• *RQ2*:How do the existent methodologies propose to address Service design?

In order to attain an in-depth understanding of the existent methodologies, it is necessary to analyse how they propose to tackle the service design process: what are the stages into which the methodology is broken down?; how are these stages tackled?; on what aspect does the proposal place most importance? (e.g. does it consider the customer's active participation to be important? does it focus on creating value for the company and its customers?), what is the orientation of the proposal? (Product or Service), and does it allow the complete lifecycle of the service to be carried out? The interest of this research lies in discovering how the various methodological proposals for Service design conceive the process.

• **RQ3**: What techniques do existing proposals suggest for Service design?

Several techniques or tools can be used for Service design. Some of them are very well known, such as the Canvas business model [11] or Key Performance Indicators (KPI) [12]. Some other exists which are related to quality assessment, such as the House of Quality [13], or are even software suites, such as Arena Simulation [14]. In other words, there is no single technique or tool, but they all make a significant contribution to the service design process. With our research we are, therefore, interested in identifying the various techniques and tools suggested by each proposal, in order to discover the strengths of each one.

• **RQ4**:What are the limitations of the existing proposals for Service design?

The objective of this research question is to combine the responses to the previous research questions (RQ1, RQ2 and RQ3) with the objective of discovering the deficiencies or limitations found in the methodologies proposed for Service design. Our interest in this respect, therefore, lies in investigating whether there is room for improvement in this area.

• **RQ5**:What are the main forums in which works tackling the theme of Service design are published? (e.g. journals, books, conferences).

The objective of this research question is to discover whether there are forums in which Service design have attracted more interest, which has therefore led us to identify the places in which the related studies have been published. The interest as regards this aspect of our research is to determine the relevance of the sources in which the publications were found. We have, therefore, taken into consideration the commonly accepted criteria to assess the quality of academic research, such as the Journal Citation Reports (JCR) or the Computing Research and Education Association of Australasia (CORE) rankings. Our intention here is to obtain a general view of the impact and evolution of this theme in literature. It is important to mention that, although CORE ranks mainly Computer Science conferences, previous searches carried out in the context of this study revealed that Service design is in fact related to the field of Computer Science, being addressed by several publications in the field. We therefore decided to consider CORE data for this study.

2.2 Data sources and query string

The planning stage also involves the definition of a search strategy in order to collect all the studies that contribute to this systematic literature review. It is, therefore, necessary to define where the search is to be carried out and which key words are used to do so [8], [9]. Table 1 (below) shows the digital libraries selected for this study. Please note that the subject of study is interdisciplinary and we therefore selected digital libraries related to social sciences, engineering or technology. This, in turn, enabled us to increase the possibilities of finding results.

Table 1. Digital Libraries used for the search process

Acronym	Name	Web
ACM	ACM Digital Library	http://dl.acm.org
GS	Google Scholar	https://scholar.google.com

IEEE	IEEEXplore	http://ieeexplore.ieee.org
SD	Science Direct	http://www.sciencedirect.com
SC	Scopus	https://www.scopus.com
WoS	Web of Science	https://apps.webofknowledge.com

On the other hand, the query string was built by combining different key words related to the subject of study with Boolean operators (AND, OR) to join and relate them. This resulted in the following search string: (Methodology OR Technique OR Tool OR Model) AND (Service design OR Service Creation OR Service specification OR Service Innovation OR Servitization) Since each of the digital libraries uses its own syntax, the main string presented was adapted to each search engine, as is shown in Table 2

Table 2. Search String and Reach

Acronym	Search string	Reach
ACM	(("Methodology" OR "Tool" OR "Technique" OR "Model") AND ("Service design" OR "Service Creation" OR "Service specification" OR "Service Innovation" OR "servitization"))	ALL
GS	(Methodology OR Technique OR tool OR model) + ("Service design" OR "Service Creation" OR "Service specification " OR "Service Innovation" OR "servitization")	ALL
IEEE	(Methodology OR tool OR technique OR model AND ("Service design" OR "Service Creation" OR "Service specification " OR "Service Innovation"))	TITLE
SD	(TITLE-ABSTR-KEY ("Methodology") OR TITLE-ABSTR-KEY (Tools) OR TITLE-ABSTR-KEY (Technique) OR TITLE-ABSTR-KEY (Model)) AND (TITLE-ABSTR-KEY (Service design) OR TITLE-ABSTR-KEY (Service Creation) OR TITLE-ABSTR-KEY (Service specification) OR TITLE-ABSTR-KEY (Service Innovation) OR TITLE-ABSTR-KEY (Servitization))	TITLE - ABSTR-KEY
SC	TITLE-ABS-KEY (("Methodology" OR "Tool" OR "Technique" OR "Model") AND ("service design" OR "Service Creation" OR "Service specification " OR "Service Innovation" OR "Servitization"))	TITLE - ABSTR-KEY
WoS	TS= ((Methodology OR technique OR Model OR design) AND (Service design OR Service Creation OR Service specification OR Service Innovation OR Servitization))	ALL

2.3 Inclusion and exclusion criteria

Even though the search string was defined by considering the principal objective of this research, the search might retireve a number of irrelevant studies as regards this objective. According to Kitchenham and Charters [8], it is consequently necessary to define inclusion and exclusion criteria on the basis of the research questions defined, which will make it possible to filter out irrelevant studies and focus on those proposals that will provide information of interest as regards responding to the Research Questions posed, thus fulfilling the objective of this systematic literature review.

This way, this review consider only those studies published until May 2021 (inclusive), written in English and which fulfill some of the following inclusion criteria:

- The title, abstract or key words of the work include the terms Methodology and Service design (or their derivatives).

- Once the abstract has been read, the conclusion must be reached that the study focuses on the topic of Service design.

All the retrieved studies fulfilling the inclusion criteria became relevant studies. Nevertheless, despite having applied the inclusion criteria, it is still possible that some of the studies found do not provide relevant information as regards fulfilling the main objective of our research. It is, therefore, necessary to read each study in detail, bearing in mind the following exclusion criteria:

- Studies not related to the theme of Service design.

- Studies that do not propose a methodology, process, method or technique for service design process.

- Studies that present a methodological proposal for Service design, but which do not provide detailed information on how it is applied.

- Studies that are specific to a concrete scenario, i.e. those containing solutions which cannot be used to address other scenarios.

All of the studies that fulfilled the inclusion criteria, while not being rejected because of the exclusion criteria, became primary studies for this review. They were subsequently studied in depth in order to provide responses to the Research Questions.

2.4   Quality assessment

Having selected the primary studies that fulfil the inclusion criteria and have not been discarded owing to the exclusion criteria, it is advisable to have a mechanism that will allow the studies to be compared and evaluated. We therefore continued using the guidelines proposed by Kitchenham and Charters [8], [9] in order to define six Quality Assessment questions **(QA)** with which to evaluate the quality of the research in each proposal. This, in turn, provided information that enabled us to make a qualitative comparison of the proposals. The scoring mechanism was the following: YES (Y)=1, Partially (P)=0.5, NO(NO)=0. The quality assessment questions defined in this systematic literature review were:

- **QA1:** Are the objectives of the research clearly defined?

- **QA2:** Is the information presented in the research coherent?

- **QA3:** Is the research process clearly documented?

- **QA4:** Can the results or contributions presented in the research considered to be of good quality?

- **QA5:** Are the limitations of the study shown?

- **QA6:** Do the conclusions presented coincide with the objectives of the research?

2.5 Data extraction

The next part of the planning process consisted of defining the process that would be carried out to collect data [8], [9] which would enable us to extract all the necessary information from each of the relevant studies so as to provide responses to the research questions considered in the systematic review. In particular, we first collected all the basic information about each of the studies selected, such as:

- Title and author.

- Abstract.

- Publication(e.g. journal, conference) and year of publication

- Digital Libraries.

The aforementioned information would made it easier for us to identify each study and provide us with a more rapid access to the studies. When defining the extraction process, we decided to extract the key information as well that would allow us to carry out an in-depth analysis of each of the proposals being studied. Regarding this study, we considered that it was important to extract the following information from each proposal:

- **Lifecycle:** this is part of a company's strategy and refers to the development that products or services undergo from when the idea for them is conceived until their decline. In this research, it was of interest to discover whether the proposals studied contemplate the complete lifecycle of services [15]

- **Method:** in this research, we were interested in discovering whether the proposals presented a sequence of steps to be followed in order to carry out the service design process, e.g. whether they show the procedure employed in an ordered manner, from detecting the user's requirement (problem) to the moment at which the prototype has been tested.

- **Models:** our objective here was to identify whether the proposals studied clearly present how the service design process should be carried out. E.g. in the prototype phase, they show how the prototype was constructed, represented and refined.

- **Automation:** it was of interest to our research to discover whether the proposals studied suggested tools with which to automate the various activities comprised in a service design process.

- **Co-Creation:** a business strategy focused on the customer's experience and interactive relations. Co-creation allows and stimulates more active participation on the part of the customer in order to create a value-rich experience, in order to produce a valuable result for both parts working together[16]. In this research, we were interested in discovering whether the proposals studied involved the customer in service design or redesign.

- **Lean**:another of the objectives of this research is to discover how difficult it is to set the proposals in motion, i.e. can the proposal be implemented without any great difficulty, or does it require complex processes in which the company must invest a great deal of time and resources? In this sense we were interested in identifying to which extent can the proposal be said to adopt some (if any) of the Lean principles.

- **Service-Oriented:**we wished to know which of the proposals studied were effectively oriented toward the design of services, products or even product-services. User-Oriented:this is a philosophy that allows the creation of products or services that will fulfil the customer's needs. In this research, we wished to discover whether the proposal considers user orientation as a mandatory basis.

- **Reengineering:**considered as s is a continual improvement process that provides the company with multiple benefits, it implies constant analysis and eventually redesign of the processes in order to improve the functionality delivered by the service or its performance[17]. We wished to discover consequently whether the proposals consider continuous improvement as something to take into account.

- **Value:**here we were mainly interested in discovering whether existing proposals put the focus either on the consumer or the provider in terms of value creation when designing the service.

Since we found various works referring to the same proposal or even by the same authors, we decided to group them together into Groups of Primary Studies (**GPS**) with the aim of making the data extraction, evaluation and representation processes easier. Therefore, studies appertaining to the same proposal were grouped into GPS by considering the following factors: a) that the hypotheses of the studies evaluated were the same, and b) that the works each had one or more authors whose ideas belonged to the same research line. The use of this grouping, the data extracted from each proposal and the quality assessment values enabled us to respond to the first four research questions (RQ1 - RQ4). The basic data extracted also allowed us to categorise the studies according to their publication type, which provided information that would subsequently be used to respond to the last research question (RQ5).

2.6   GPS assessment

Having grouped the studies, we then went on to evaluate them. In this subsection, we shall therefore define six GPS Assessment questions (GA) and scores for them, which were used to evaluate the groups of primary studies established. The scoring procedure used was, according to the type of responses, the following: YES (Y)=1, Partially (P)=0,5, NO(N)=0. The GPS Assessment questions defined for this SLR are the following:

- **GA1:**Does it provide a methodological proposal in order to carry out the service design process?
  (Y) It provides a complete methodological proposal in order to carry out the service design process. (P) It suggests the use of a particular method, model or technique - but not a complete methodological proposal covering the whole lifecycle - that makes it possible to carry out the service design process. (N) It does not provide any

methodology, method, model or technique that will make it possible to carry out the service design process.

- **GA2**:Does it show how to implement and deploy the methodological proposal?
(Y) It provides a precise description of how to implement the methodological proposal (e.g. it describes the stages contemplated by the methodology proposes, in addition to providing the method or technique that should be used and the tools recommended for each stage). (P) It partially describes how to implement the proposal, or describes how to implement methods, models and/or techniques in order to carry out the service design process. (N) It does not describe how to implement the methodological proposal.

- **GA3:**Is it a User-Oriented proposal?
(Y) It takes user orientation into consideration as a relevant element. (P) It considers some aspects of user orientation (e.g. it considers the user in the requirements definition, but not in the service design). (N) It is not User-Oriented.

- **GA4:**Does it consider the customer's active participation (Co-creation) in the service design process?
(Y) It considers the customer in the requirements analysis, design, prototyping, validation and the launching of the service. (P) It considers the customer to be the Co-Creator of certain stages. (N) It does not consider the customer to be a Co-Creator.

- **GA5:**Can it be applied to service design processes?
(Y) It makes it possible to completely reengineer the service when it is already being consumed by the user. (P) It contemplates the realisation of reengineering processes in some of the stages (e.g. it is possible to continually improve the provision of the service, but not to identify the customers' needs). (N) It does not contemplate the possibility of a reengineering process.

- **GA6:**Does it suggest a tool with which to automate the service design processes?
(Y) It suggests a technique that can be used to completely automate the service design processes. (P) It suggests a tool with which to automate some of the service design processes. (N) It does not suggest techniques withc which to automate the service design processes.

3   Execution

This section shows how this SLR was carried out. This process was defined by following the proposal of Pino (2008) [18]. The process adopted basically consists of the three stages shown in Figure 2: search process, selection of primary studies and data extraction. Each of these stages is explained as follows.
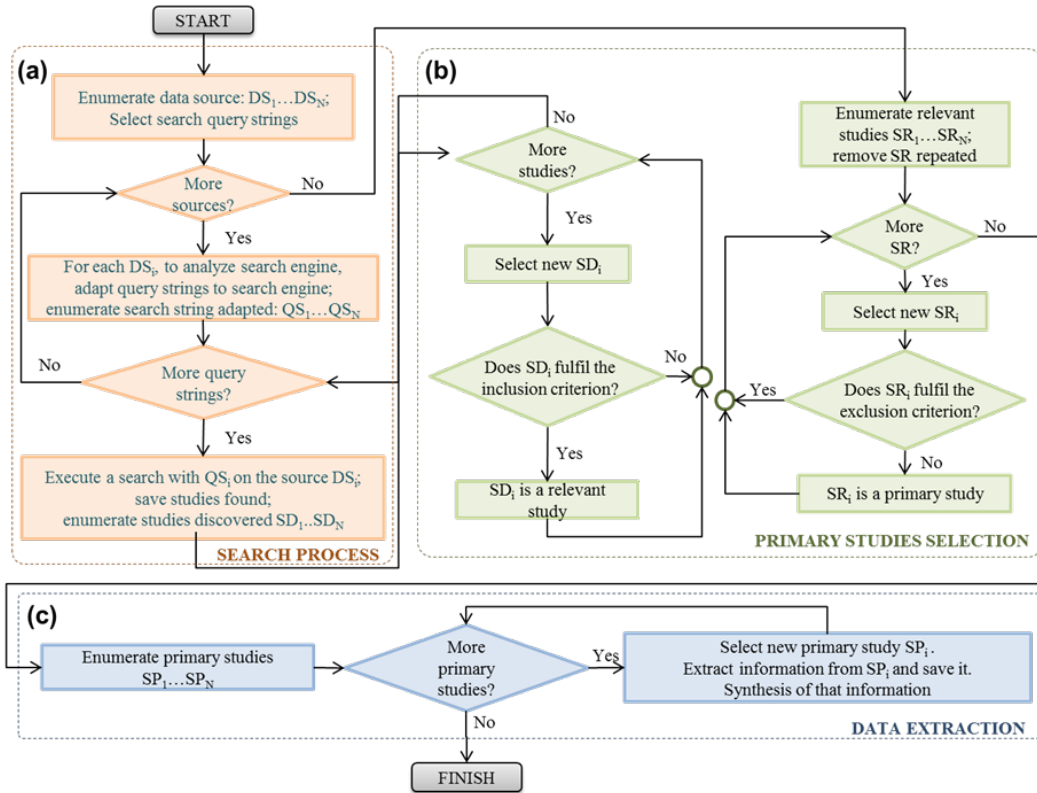
Fig. 2. Process followed to conduct the review: (a) search process, (b) primary studies selection and (c) data extraction, by Santiago et al. in [16]

Search process: as is shown in the figure (a), the execution process began by deselecting and enumerating the digital databases to use and the query string. Once this information had been identified, we then went on to analyse the search engines independently in order to adapt the query string to the characteristics of each of them. We subsequently began to search for studies by running the search in every engine with the corresponding adapted query string.

We then enumerated and stored the studies obtained. We also began to extract some of the data from them, such as their titles and authors, in order to facilitate their subsequent identification. Once the studies had been identified, we moved on to the study selection stage.

Selection of primary studies: as is shown in the figure (b), during the execution, each of the studies identified in the previous stage was analysed with the objective of discovering whether they fulfilled the previously defined inclusion criteria. Those studies that satisfied the inclusion criteria then became relevant studies for this systematic literature review. This process was repeated for all of the studies retrieved.

Once all the relevant studies had been identified, the second part of the selection stage began. This phase basically consisted of enumerating the relevant studies, eliminating any duplicated studies and, finally, analysing each of the relevant studies in accordance with the exclusion criteria defined. This last task allowed us to exclude certain proposals from the set of primary studies chosen for the systematic review.

Data extraction: as is shown in the figure (c), this is the final stage in the execution process, during which we analysed the primary studies that would definitively contribute to the systematic literature review. The following section presents therefore a detailed analysis of each of these studies in order to extract the information that is considered important in this research and which has allowed us to fulfil the objectives and respond to the research questions of this review.

4 Results

This section shows the main results obtained of this systematic literature review. Please recall that the primary studies were grouped into Groups of Primary Studies **(GPS)** for which the different GPS Assessment questions **(GA)** will be answered. The different Quality Assessment questions **(QA)** are not responded therefore for each primary study, but rather for each GPS.

4.1 Search and selection of primary studies

In accordance with the description of the process followed to conduct the systematic review, the first step consisted of running the searches in each digital library. The query string was then adapted to the syntax required by each digital library as shown in Table 2. On the other hand, Table 3 shows that these searches resulted in 4366 documents along with the number of studies retrieved from each library.

Table 3. Search results

Digital Library	Search Results	Relevant Studies (RS)	% of Relevant Studies	% of ALL the Relevant studies
ACM	307	10	3,26	3,48
GS	980	26	2,65	9,06
IEEE	1385	32	2,31	11,15
SD	830	33	3,98	11,50
SC	276	31	11,23	10,80
WoS	588	155	26,36	54,01
TOTAL	4366	287	6,57	100,00

The next step consisted of selecting the relevant studies, which is to say, evaluating whether the studies recovered fulfilled the inclusion criteria. This procedure led us to obtain that only 287 of the 4366 originally found were relevant studies, i.e. only (6.57%) of the documents recovered were relevant for our SLR. These results are shown in column three of Table 3 . Fourth column shows the percentage of relevant studies as well found in each library and the global percentage (6.57%) of relevant studies, which was obtained by considering the total number of documents found in the various databases and the total number of relevant studies provided by those databases.

Note that the digital library that returned most relevant results was the Web of Science (WoS), with (26.36%), followed by Scopus with (11.23%). It is important to note that these search engines were two of the three that returned the fewest documents. Another search engine that returned very few documents was ACM (307), but it only provided 10 relevant studies, which is to say 3.26%. This leads us to the conclusion that WoS and Scopus are the most precise search engines as regards the quantity of relevant studies obtained with regard

to the few relevant studies identified from the different search engines (6.57%). This is owing to the fact that many of the documents contain some of the key words but proved, when analysed, to be unrelated to the theme being studied in this SLR and were consequently excluded. It is important to mention that the results were stored after each of the steps carried out, thus making it possible to recreate the search if necessary.

The last column of the aforementioned table shows the percentage of relevant studies obtained from each library with regard to the total number of relevant studies found in the review. The data in this column allow us to observe that the majority of the relevant studies were found in WoS (54.01%), followed by Science Direct (11.50%), IEEExplore (11.15%), Scopus (10.80%) and Google Scholar (9.06%). It will be noted that the last four search engines mentioned returned a similar percentage of documents, while that which returned the lowest was ACM (3.48%). However, we are unable to state that these data are conclusive, since many of the relevant studies were found in another library. For example, many of the studies found in WoS were also found in IEEExplore, and these studies correspond with publications in high-impact forums, such as JCR journals of CORE conferences.

In order to illustrate this phenomenon, Table 4 presents the duplicated relevant studies and the non-duplicated relevant studies. This makes it is possible to verify that, of the 287 relevant studies, 146 were duplicated (50.87%), i.e. these relevant studies were found in more than one database, thus leading to duplicated studies. Once the duplicated studies had been identified, the copies were eliminated, which led us to obtain a final list of 141 non-duplicated relevant studies (49.13%) from the total number of relevant studies identified from the databases. Please note that as the non-duplicated relevant studies were obtained from various libraries, it is not possible to classify them in accordance with the library from which they were obtained.

Table 4. Filtering of relevant Studies

	Studies	**Percentage**
Relevant Studies	287	100 %
Duplicated Relevant Studies	146	50.87 %
Non-duplicated Relevant Studies	141	49.13 %

Having detected the non-duplicated relevant studies, we then went on to evaluate each study according to the exclusion criteria. As a result of this, only 18 (i.e. 12.77% of the non-duplicated studies) became primary studies in this systematic literature review. We should mention that the primary studies were analysed as well in order to identify other relevant studies, but none were found. All in all, Table 5 (below) shows finally the primary studies that have been deeply organized in this systematic literature review.

Table 5. Primary studies selected

Prop	Authors	Title	Year	Publication
GPS1	M. Peruzzini, M. Germani, C. Fav	Shift from PLM Shift from PLM to SLM: A Method to Support Business Requirements Elicitation for Service Innovation[19]	2012	ICED
GPS2	Suhardi ; Pathya Madhyastha Budhiputra ; Purnomo	Service engineering framework: A simple approach[20]	2014	ICITSI

	Yustianto			
GPS3	Mario Rapaccini,Nicola Saccani, Giuditta Pezzotta, Thomas Burger. Walter Ganz	Service development in product-service systems: a maturity [21]	2013	SERV IND J
	Kan Jian	New service development for interactive experience [4]	2008	SOLI
GPS4	Claudio Sassanelli, Giuditta Pezzotta, Monica Rossi, Sergio Terzi, Sergio Cavalieri	Towards a Lean Product Service Systems (PSS) Design: state of the art, opportunities and challenges[17]	2015	CIRP
	Byungun Yoon, Sojung Kim ,Jongtae Rhee	An evaluation method for designing a new product-service system [22]	2012	EXPERT SYST APPL
GPS5	KurtulmuÅŸoÄŸlu, Feride Bahar, Fatma Pakdil	Combined analysis of service expectations and perceptions in lodging industry through quality function deployment [13]	2016	MANAGEME NT - SSCI
GPS6	Giuditta Pezzotta, Roberto Pinto, Fabiana Pirola, ohamed-Zied Ouertani	Balancing product-service provider's performance and customer's value: The service engineering methodology (SEEM) [23]	2014	CIRP
	Alice Rondini, Giuditta Pezzotta, Fabiana Pirola, Roberto Pinto, Zied M. Ouertani	Service Engineering framework: the adoption of simulation to design and configure Product-Service solutions[24]	2014	ICE
	Alice Rondini, Fabiana Pirola, Giuditta Pezzotta, Mohamed-Zied Ouertani, Roberto Pinto	Service Engineering Methodology in Practice: A case study from power and automation technologies[25]	2015	CIRP
	Giuditta Pezzotta, Sergio Cavalieri, David Romero	Engineering Value Co-Creation in Product-Service Systems: Processes, Methods, and Tools[26]	2017	IGI
	Giuditta Pezzottaa, Fabiana Pirolaa, Alice Rondinia, Roberto Pintoa, Mohamed-Zied Ouertanib	Towards a methodology to engineer industrial product-service system -Evidence from power and automation industry[27]	2016	CIRP
	Roberta Curiazzi, Alice Rondini, Fabiana Pirola, Mohamed-Zied Ouertani, Giuditta Pezzotta	Process Standardization to Support Service Process Assessment and Re-engineering [28]	2016	CIRP
GPS7	Giuditta Pezzotta, Fabiana Pirola, Roberto Pinto, Fumiya Akasakab, Yoshiki Shimomurab	A Service Engineering framework to design and assess an integrated product-service [14]	2015	MECHATRON ICS
GPS8	Ching-Hung Lee, Chun-Hsien Chen, Fan Li, An Jin-Shie	Customized and knowledge-centric service design model integrating case-based reasoning and TRIZ [29]	2020	EXPERT SYST APPL
GPS9	Sudbury-Riley, Lynn; Hunter-Jones, Philippa; Al-Abdin, Ahmed; Lewin, Daniel; Naraine, Mohabir Vic	The Trajectory Touchpoint Technique: A Deep Dive Methodology for Service Innovation[30]	2019	JSR
GPS10	Patricio, Lia; Fisk, Raymond P.; Falcao e Cunha, Joao; Constantine, Larry	Multilevel Service Design: From Customer Value Constellation to Service Experience Blueprinting[31]	2011	JSR
	Teixeira, Jorge Grenha; Patricio, Lia; Huang, Ko-Hsun; Fisk, Raymond P.; Nobrega, Leonel; Constantine, Larry	The MINDS Method: Integrating Management and Interaction Design Perspectives for Service Design[32]	2016	JSR

Please recall that the primary studies were grouped together in Groups of Primary Studies (GPS), each of which contained proposals whose research hypotheses are the same, while one or more authors may differ. Note that there is one primary study (GPS7) whose proposal is different, despite the fact that some of its authors co-wrote some of the other primary studies obtained in this review , and it has, therefore, been evaluated separately. For example: in GPS 6, it's found the service engineering methodology (SEEM), which shares authors with GPS 7

4.2 GPSs quality assessment

Once the relevant studies had been identified, the six Quality Assessment questions **(QA)** defined in subsection 2.4 were employed to evaluate the scientific rigour of each proposal. Table 6 (below) shows the scores assigned to each GPS for each QA.

Table 6: GPSs quality assessment.

GPS	QA1	QA2	QA3	QA4	QA5	QA6	Total	% Max QA
GPS1	P	Y	P	Y	N	P	3,5	58,33
GPS2	P	Y	Y	Y	P	Y	5	83,33
GPS3	Y	Y	Y	Y	N	Y	5	83,33
GPS4	Y	Y	Y	Y	P	Y	5,5	91,67
GPS5	P	Y	Y	P	N	P	3,5	58,33
GPS6	Y	Y	Y	Y	P	Y	5,5	91,67
GPS7	Y	Y	Y	P	Y	Y	5,5	91,67
GPS8	Y	Y	Y	Y	P	Y	5,5	91,67
GPS9	Y	Y	Y	Y	Y	Y	5	83,33
GPS10	Y	Y	Y	Y	Y	Y	6	100,00
Total	8,5	10	9,5	9	5	8	50	
%Total Score	17,00	20,00	19,00	18,00	10,00	16,00	100,00	
% Max GA	85,00	100,00	95,00	90,00	50,00	80,00		

After assigning a score for each QA to every GPS, we then summarized the results obtained in Figure 3. Note that the graph is organised in an ascending manner, which facilitates the interpretation of the scores obtained for each QA. For example, QA5 obtained the lowest score (5), and this makes it easy to determine that the majority of the GPSs analysed in this study do not state clearly which the limitations of the study are.
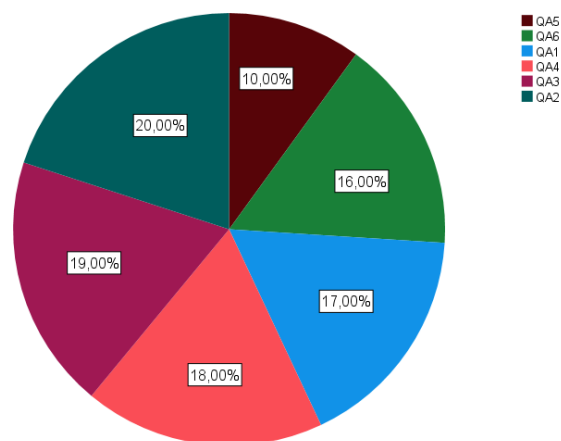

Fig.3. Score for QAs

4.3 Data extraction results

Having identified and grouped the primary studies, the information considered important for this study was extracted from each GPS. This information extraction enabled us to respond to the research questions proposed, which were specified in subsection 2.5. The data extracted from each GPS is summarised in Table 7.

Table 7. Data Extraction

	GPS1	GPS2	GPS3	GPS4	GPS5	GPS6	GPS7	GPS8	GPS9	GPS10
Lifecycle	High	High	High	Low	Medium	High	High	Low	High	High
Method	High	High	High	High	High	High	High	High	High	High
Models	High	High	High	High	High	High	High	High	High	High
Automation	Medium (Use Case AS-IS/ TO BE)	Medium (Canvas Blueprinting Comunication Foundation)	Not defined	Medium (Software Arena)	Not Defined	Medium (Blueprinting)	Medium (Blueprinting Use Case AS-IS/ TO BE)	Not Defined	Medium (Touchpoint cards)	Medium (Blueprinting Affinity diagrams, Activity Diagram Touchpoints, Customer Journey)
Co-creation	Not Defined	Not Defined	High	Not Defined	Not Defined	High	High	Medium	High	High
Lean	Medium	Low	Low	Medium	Medium	Medium	High	High	Medium	Medium
Oriented-Service	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Medium
User-Oriented	Medium	Medium	High	Medium	Medium	Medium	Medium	Medium	High	High
Reengineering	Not Defined	Medium	Not defined	Not defined	Not Defined	High	Not Defined	Not Defined	Medium	Medium
Value	Medium (Company)	Medium (Customer)	Medium (Customer)	High	High	High	Medium (Company)	Mediun (Company)	High	High

Note that the majority of the proposals consider the entire service lifecycle and also present methods and models with which to carry out the service design process. The majority of the proposals partially contemplate automation as well, i.e. some of the activities considered in the methodological proposal presented are automated, principally those related to the prototyping (e.g. Blueprint).

It will be observed that five of the GPSs consider Co-Creation - integrating the customer into the service design process - as part of their proposals, and, according to our evaluation, the level of difficultly involved in applying the proposal is medium, while only two proposals are completely oriented towards being used as tools with which to design services: the rest focus on the design of both products and services, and just three proposal is completely oriented towards fulfilling the final users' specific needs (GPS3, GPS9 and GPS 10). Note as well that few of the proposals contemplate a continual improvement process, which would help to create competitive advantages and innovation. And to conclude, only five   of the proposals focus on providing value for either the customer or the company. The results

obtained make it possible to deduce that, although proposals for the design of products-services exist, the definition of methodological proposals whose focus is on services is still somehow inmature, thus leaving considerable room for improvement.

4.4 GPSs assessment results

Once the data extraction process had been carried out, we then went on to evaluate each of the proposals through the use of the GPS Assessment questions (GA) defined in subsection 2.6). The scores assigned to each study for each question are shown in Table 8.

Table 8. GPSs quality assessment

ID	GA1	GA2	GA3	GA4	GA5	GA6	Total	% Max GA
GPS1	Y	Y	P	N	N	P	3	50,00
GPS2	Y	Y	P	N	P	Y	4	66,67
GPS3	Y	Y	Y	Y	N	Y	5	83,33
GPS4	Y	Y	P	N	N	P	3	50,00
GPS5	Y	P	P	N	N	N	2	33,33
GPS6	Y	Y	P	Y	Y	P	5	83,33
GPS7	Y	Y	P	Y	N	P	4	66,67
GPS8	Y	Y	P	P	P	P	4	66,67
GPS9	Y	Y	P	Y	P	Y	5	83,33
GPS10	Y	Y	Y	Y	Y	Y	6	100,00
Total	10,00	9,50	6,00	5,50	3,50	6,50	41,00	
%Total Score	24,39	23,17	14,63	13,41	8,54	15,85	100,00	
% Max GA	100,00	95,00	60,00	55,00	35,00	65,00		

The pie chart of Figure 4. illustrates the distributions of these results. For example, GA1 and GA2 are distributed out more than 47 % of the total score obtained by the set of GAs, so most of the studies include some methodological proposal and consider its automation, at least, to some extent, while GA5 makes the smallest contribution to the total score, from where we can infer that continuous improvement is not a matter of interest for existing proposals. It is worth mentioning that the proposals analysed achieved better results as regards their scientific rigour (8) that their content, which is to say that even when the proposals studied were correctly conducted and presented from a scientific point of view, there is room for improvement as regards what was actually proposed.
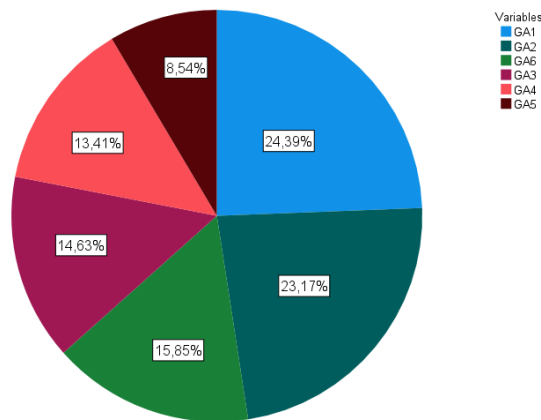

Fig. 4. Sores for the GPS Assessment questions

5 Discussion

We shall now present a discussion of the main results of the review by responding to the Research Questions posed in section 2.1 using mainly the results presented in Section 4.

What methods currently exists to guide service design processes?

The importance of service design in order to understand the customer's real needs, which should at the end of a correct process design be the characteristics of the service provided, has been mentioned throughout the process employed to carry out this systematic literature review. However, a correct service design is not always achieved, since services or products are rarely focused on the customer's needs (expectations). Service design is generally influenced by the company's objectives, or more probably by what the top management considers to be important. When the decision is made to launch a new service onto the market without considering the customer's needs or expectations, the result may be that it is one of several services or products that do not satisfy customers' needs.

Owing to the above, the interest of this research lies in determining the existence of methodologies, techniques, tools or methods with which to design services that are focussed on understanding the customers' expectations and which make them the co-creator of these services and the centre of the entire design.

In order to address RQ1 we have evaluated the proposals by analysing the results of GA1, which verifies whether the proposals suggest any methodologies, techniques, tools or methods with which to carry out the service design process. This enabled us to discover that all the proposals (100%) suggest some type of mechanism with which to carry out the service design process. The answer to this question was indeed supposing 24.39% of the total score achieved by the answers to the GAs (see Figure 4).

Some of the main methodological proposals found are: Service Lifecycle Management (SLM) [19], which starts from the premise of discovering how the product or service is designed and how it is perceived by the customer and the value of the market, to later propose improvements once the scenario into which it will be introduced has been well understood. The Service engineering framework [20] is, meanwhile, a simple framework that proposes three phases with the intention of identifying the value that the customer wishes to attain. Another interesting proposal is New Service Development (NSD), which is focussed on improving the customer's experience and tackles new concepts with regard to the theme studied, such as including the need to create an emotional connection with customers in order to be able to design a service that fulfils the customers' real expectations. There are also proposals that focus on evaluating and improving quality, such as the renowned Yoji Akao' Quality Function Deployment (QFD) [34], while SErvice Engineering Methodology (SEEM) [23] proposes that a balance should be maintained between the value perceived by the customer and the company's internal efficiency. For their part, in the Knowledge-centric innovative service design (KISD) [29] proposals, the authors propose a model that allows accelerating the design of personalized service, which causes an innovation in the service. But it is known that not all innovation means a value proposition for customers, since companies tend to put emotions aside, addressing this casuistry is the trajectory touchpoint

technique (TTT) [30], which takes advantage of the customer experience to understand service requirements, which in turn drives innovation

Two interesting works were found that complement MSD [31]and MINDS [32], the first addresses how to design complex service systems, and the second integrates two service design perspectives to support the design of innovative technology-enabled services. The fist one is management perspective encompasses contributions from service management, marketing, and operations and the seconds the interaction perspective encompasses contributions from interaction design. All of the proposals mentioned provides contributions to the various stages of service design.

How do the existent methodological proposals address Service design?

In order to respond to this question, we considered the results obtained from GA2, GA3, GA4 and GA5, which were discussed in subsection 4.3. In light of the results of GA1, which showed that all of the proposals suggest some sort of methodology with which to carry out the service design process, we were subsequently interested in discovering whether these proposals providing a complete description of the methodological proposal that showed how to put it in practice (GA2), and also whether they were User-Oriented proposals (GA3), considered Co-Creation (GA4) or it was possible to carry out reengineering with them (GA5).

As will be observed in subsection 4.4 , GA2's score was 95.00%, since all of the proposals but GPS5 provides a detailed description of the methodological proposal posed. With regard to whether they are User-Oriented proposals, GA3 achieved 60% of the maximum score since just one of the proposals could be said to be user-oriented while the rest of them are partially oriented to the user. Another one of the key aspects that we wish to discover is whether existing proposals consider Co-Creation (GA4) for Service design. The results (55.00%) come from the fact that only five of the proposals (GPS3, GPS6 GPS7,GPS9 and GPS10) do consider Co-Creation as part of the design process, while the rest of them (GPS1, GPS2, GPS4 and GPS5) do not consider it. Finally, we wished to discover whether the proposal could be used for redesigning products or services that are already offered (GA5), i.e. when they have already been launched onto the market. The results obtained show that the majority do not contemplate reengineering processes. Question GA5 was in fact the one which attained the lowest total score (35.00%) since GPS6 is the unique one contemplating the realisation of complet reengineering. All this given, it is worth noting that, even though customers are the end consumers of services or products, they are frequently not involved in the designing process.

What techniques do existing proposals suggest for Service design?

To respond to this question, we consider the data gathered by GA6, whose aim was to identify whether the proposals suggest a technique or tool with which to automate service design processes. The total score obtained for GA6 was 57.14%, which indicates that about half of the proposals suggest some type of automation. In particular, those that specifically suggest ways of automation all along the process are GPS2 and GPS3, while GPS1, GPS4, GPS6 and GPS7 make suggestions for some of the stages of the process and GPS5 does not make it all. Note that the technique most frequently used in the proposals analysed is blueprinting [14],

[19], [24], [28], [31], [32], [35] while use case representation (AS-IS and TO-BE) is used on a lesser scale. One of the proposals uses ARENA software for simulation processes and Communication Foundation (WFC) for the prototyping phase.

What are the limitations of the existing proposals for service design?

An analysis of the responses to RQ1-3 enabled us to discover some of the limitations and points for improvement regarding methodlogical proposals for Service design.

As mentioned in subsection 4.1, all the proposals introduce some kind of methodology in order to drive or guide the conduction of Service design processes. However, as is shown in subsection 4.2 , even though most of the proposals provide some contribution regarding the way Service design should be addressed, only one proposal could be branded as a user-oriented approach. This indicates that among all the proposals analysed, only three locates the customer at the centre of everything and considers that the most important aspect is the user's understanding and needs. We should mention that a user-oriented approach is key to the produce services that satisfy the customer's real expectations. The issue related with the lack of user-orientation in existing proposals is probably related with the fact that although the term user-oriented has been employed in literature for many years now, it is considered to be an emergent theme in practice, particularly in the service sector[36].

Moving to another point, co-creation is one of the concepts that has had a great impact on both academic and industrial contexts in the last years. It has been widely used by renowned brands on the market, such as Nike and Hewlett Packard, and what makes this concept truly interesting is that it includes the customer as a protagonist in the design of the experience (service), but it is not limited to considering only the client, but also the company's staff, from the top management to the person who deals directly with the client, forming an 'architecture of participation'[39]. This makes it possible to design services that are not only adjusted to the customers' real needs (expectations) but also to what the provider can actually offer, ensuring that people in the frontend will be as well in line with the idea of the service from the very beginning and ready to serve fulfil customer expectations. Nevertheless, just five of the proposals found by this review consider co-creation at the time of deploying service design projects. We therefore consider that there is much room for improvement in this area.

On a different mater, current markets are totally dynamic and completely focused on providing both the customer and the company with value. This dynamism demands that companies should be in a constant state of change and not think only of a globalised world or economy, but rather of an economy based on globality, a concept coined by Hemerling and Bhattacharya in [37], to reflect the constant change that should be incorporated into companies if they are to be competitive. It is, therefore, fundamental for service design methodologies to be able to provide guides to drive reengineering of the current service offering. However, only one of the prop osals analysed considers this possibility.

Finally, another aspect that could be improved concerns the tools used or suggested to support the automation of service design activities (subsection 4.5). The majority of the proposals found consider the partial automation of some of the activities comprised in a service design

project, such as prototyping. However, at least as regards the proposals studied in this review, we were unable to find either any tool that would make it possible to support the whole process or a tool that has been specially constructed for the design of services.

What are the main forums in which works tackling the theme of Service design are published? (e.g. journals, books, conferences)

We shall respond to this question by presenting three charts. The first one, Figure 5, shows the distribution of the primary studies in the different publications. As will be noted, the primary studies that were published in journals are distributed as follows: (23.08%)Journal Of Service Research, (23.08%)CIRP Annals-Manufacturing Technology, (15.38%) Expert Systems With Applications, (15.38%)CIRP Journal Of Manufacturing Science And Technology. In the case of conferences and books, the distributions are dispersed, i.e. there is no more than one publication in each conference or book. Beyond these observations, owing to the small number of primary studies found in this review, we can conclude that the theme dealt with is still an emerging area. Besides, as mentioned previously, it is an interdisciplinary theme, and one of the areas to which it is most closely related is that of computer science. This is something that the journals in which the documents comprising this review were published has served to confirm.
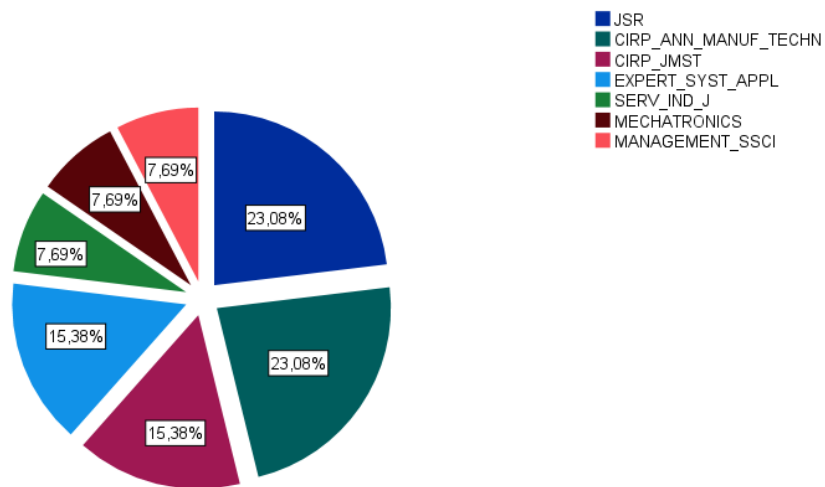

Fig 5. Distribution of studies

Having obtained the aforementioned results, we then went on to analyse the studies by ranking (level) and type of publication. The results of this analysis are shown in Figure 6 this review were published has served to confirm.
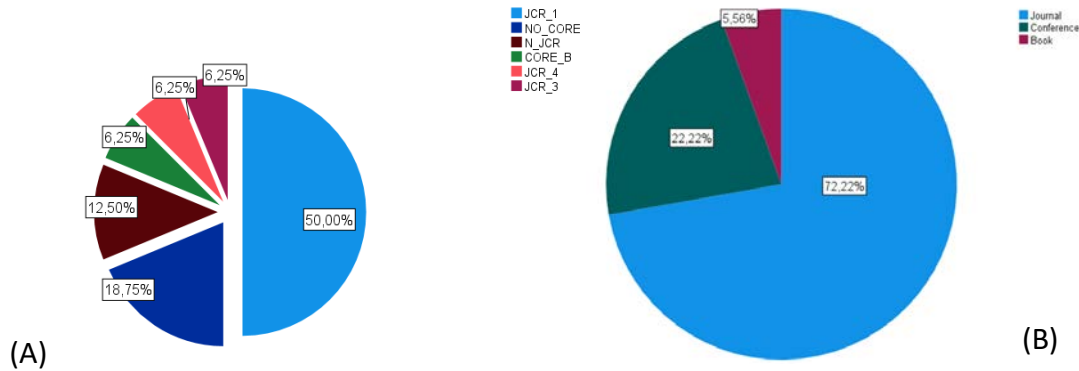
Fig 6. Distribution of studies by publication: (A) By Ranking. (B) By Type.

As will be observed in Figure 6(A), journals in the first quartile (50.00 %) are the ones accumulating more studies, followed by publications that do not appear in any ranking (18.75%), while it is worth noting that books are also comprised in this category, and non-ranked conferences. Impact conferences (ranked in CORE), on the other hand, do not seem to be a forum where works on service design are published. The remaining distributions are considered to be dispersed, since they do not include more than one publication per ranking. With regard to the distributions of publications per type (book, journal or conference), Figure 6(B), shows that the majority of the primary studies considered in this review were published in journals (72.22%), followed by conferences (22.22 %) and finally, books (5.56%). All of the above allows us to conclude that the type of publication most prone to publish works on service design are JCR journals. We are however of the opinion that very few publications deal with this theme, but that it is undergoing a gradual growth and there is increasingly more interest in this subject, according to the year of publication of the studies comprised in this review.

6   Conclusions

Digital transformation, globalization and some other trends have drastically changed the industrial landscape in the recent years [38]. As a response, organizations have made an effort to adapt to these changes, embracing new disciplines and practices at a pace that not even the academia has been able to cope with [39]. This is the case for us of Service design, which is a field of interest for some of the bigger companies on earth (for example IBM), deserving even an ad-hoc department to lead the first steps in the development (or reengineering) of services and is still somehow an immature field for academics.[40]

In order to check this hypothesis and in an attempt to provide a good overview of the current landscape, this work has presented a systematic literature review whose objective was to identify and analyse existing methodological proposals for service design. The review, which has been conducted according to the guidelines provided Kitchenham and Charters [8], [9] and Biolchini [10], enabled us to identify 18 primary studies, which were grouped together as 10 proposals and which were then studied in depth.

This analysis led us to the conclusion that several methodologies which can be used to design services currently exist. However, they are not focussed on the customers and do not,

therefore, really allow those customers' real needs to be identified. This in turn prevents these needs from being fulfilled by the service provided.

Likewise, even when the proposed methodologies have not been designed exclusively for services, their application may make it possible to address Service design projects, since they deal with all the stages in the service lifecycles in addition to presenting how each of them should be carried out. They also present techniques or tools that allow some of the stages to be automated. One example of this is the use of Blueprinting for the initial design stage. However, at least in the proposals studied, we have been unable to find any tool that provide support to the whole process or that have been specially constructed for Service design.

To conclude, we should place special emphasis on the idea that there is room for improvement regarding the specification or improvement of a methodology for service design that will enable and stimulate the customer's active participation, and that will principally focus on Co-Creation, without dismissing the need of dealing with services reengineering

This review has confirmed as well that service design is an emerging filed which is becoming more relevant in the literature. In spite of this, it is not possible to determine the authors who are principally contributing to the growth of this filed. It would, therefore, be interesting to carry out a bibliometric study that would enable us to measure the indicators of activity in this theme. We should mention that we have verified that no other study of this type currently exits, signifying that it makes a significant contribution to literature and may provide an important basis for other research in the Service Design area.

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