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Problem-Solving Design-Platform Model Based on the Methodological Distinctiveness of Service Design

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Abstract: This study explores the differentiated properties of service design in the context of the final value pursued by this methodology, avoiding the interpretation of pending issues to which service design is applied. First, the following were identified as the core properties of service design, differentiated from other design methodologies: "Design Thinking", a creative problem-solving process; "User Experience Value", the pursued goal; "Participatory Design", a practical research methodology; and "Interaction between Users and Providers", the core research scope of pending issues. Second, the study proposed a six-step service design process model based on the interrelationships between these properties. The "problem recognition" step identified a decline in the quality of user experiences and forms a self-awareness of dissatisfaction. Next, the "problem understanding" step conducts multidisciplinary cooperative research on dissatisfaction. Subsequently, the "problem deduction" step determines users' unsatisfied desires through visualization of the core pending issues, and the "problem definition" step performs creative conception activities with problem-solving approaches for the unsatisfied desires. Further, the "problem-solving" step develops service design models, and finally, the "problem-solving strategy check" step confirms the utility of the models in a real-world application.

Key Contribution: *Relevance to Design Practice*—There is a lack of well-established and uniform criteria to define service design. Although previous studies have found it difficult to develop such criteria, our study can help address this lack by determining the distinctiveness of service design.

1. Introduction

Service design has been attracting increasing attention in recent years as a practical strategy for developing human-centered solutions for contemporary issues that cannot be resolved by pre-existing norms and systems; such issues are found in a wide range of social domains, including urban environments, public services, and medical care. The concept and methodology of service design were validated in the 1990s, and in the 2010s, the process model began to be actively developed by the design industry and academia; however, there is as yet no consensus on a clear definition or scope of service design. According to reports by Mandano Partnership [1] and by the Service Design Research Network in 2013 and 2014 [2], most agendas handled by service design are "wicked problems" [3], which refer to atypical and invisible problems generated as a result of complicated relationships between stakeholders. However, the establishment of clear criteria to define the essential properties and process of this methodology is hampered by the mixed-use of diverse research tools for approaching such problems, changeable processes that depend on circumstances, and difficulties in standardizing performances. Considering this, the present study primarily aims to identify the methodological distinctiveness of this concept by analyzing service design in comparison with pre-existing problem-solving methodologies.

To this end, this paper avoids making overt interpretations of this methodology and identifies its distinctive properties in the context of end-goal-oriented value. On the basis of this distinctiveness, this study ultimately aims to propose a service design platform that could function as an effective solution for problems, as well as "an activity to improve service" [4].

This study is carried out as follows. First, the study begins with a discussion of the importance of the study topic, and a definition of the key areas. Second, a review of previous studies establishes a theoretical framework; in particular, we investigate the broad and narrow definitions of service and compare service design with other problem-solving methodologies. Specifically, this study explores the following key questions: (1) How does service design differ from other provider-centered methodologies that focus on the improvement of service productivity and efficiency? (2) How does service design address problems?, and (3) What is the ultimate goal of service design? Third, on the basis of the above analysis, this study determines the distinctive nature of service design methodology. Finally, the study proposes a service design platform that could solve wicked problems and improve user experience value. It also presents suggestions for feasible follow-up studies on this topic.

2. Theoretical Review

2.1. Service and Service-Dominant Logic

The dictionary definition of "service" is "the action of helping or doing work for someone" [5]. In the 20th century, when the goods-dominant logic based on the economy of manufacturing-centered industry was prevalent, the production of goods was believed to be an essential economic activity that contributed to increasing national economic power, and the goods themselves were considered to bring satisfaction to customers [6–9]; meanwhile, at this time, service was perceived as an additional activity aside from goods, an activity that is rather consuming and counterproductive [9,10]. However, in the 21st century, when the paradigm of consumption shifted from materials to emotions and experiences, the focus of the economy structure re-shifted to symbolic consumption and services that met customers' personal preferences and expectations [11]. This implies that the value of service was extended to the entire consumer experience, including the provision of both material and non-material goods to customers, not to mention the additional service activity accompanied by tangible goods. This perception is based on the service-dominant logic proposed by Vargo [12]. According to this logic, service value increases when customers accumulate positive experiences in regard to their purchasing activity, as opposed to experiences relating to the functional aspects of the goods they purchase. In addition, this logic is tied to the value-in-use meaning of value, which explains the lack of distinct boundaries between service providers and receivers [13,14]. Thus, the company-customer interface is created through the "use of goods", not the "exchange of goods". Customers, along with providers, became co-creators of value, which in turn drives the eco-system of service production and supply [15]. Table 1 presents a comparison of the two types of logic.

In recent years, with the proliferation of servitization in all industries, caused by the value of services increasing as it becomes more difficult to differentiate the technical features of products from those of other related products, there is a rapid emergence of Product-Service Systems (PSS) that integrate tangible goods and intangible services [16]. PSS are defined as a marketable set of products and services capable of jointly fulfilling customers' needs in an economical and sustainable manner [17–19]. Driven by the need for more effective and sustainable use of our planet's resources, research on PSS reveals a high potential of such systems to balance economic, social, and environmental benefits [18–21]. For example, customers who are not regular car users may choose to use car-sharing solutions rather than buying a car, which is both a sustainable and resource-efficient solution [22]. Such improvements tend to add uptime or total-care services, which could lead to the intensive use of products and timely replacement with newer, more efficient, and innovative products [18,21]. Even the latest environmental legislation pushes for manufacturers to take care of their product throughout its life cycle, with particular concern for the disposal stages, in accordance with the well-known "polluter

pays principle". From this perspective, activities such as maintenance, repair, and collection after use, can be performed better by the OEM rather than by a third party. With a focus on customer demands and needs, this is even the case for common products (e.g., household goods) [23].

Table 1. Comparison between service-dominant logic and goods-dominant logic.

Goods-Dominant Logic	Service-Dominant Logic
- The product itself provides the value the customer desires - Product manufacturing: an activity that helps improve the national economic power - Customer as a co-producer - Provider-centered, focus on improving productivity/efficiency	- Value of tangible goods: value is created through the service that concerns the use of the goods - Intangible asset: key for growth based on productivity - Customer as a co-creator of value - Emphasis on the significance of the service value created by the provider-user interface
▼	▼
Service refers to additional or other activities aside from products, and is considered to be counterproductive	Service value is amplified when, from the customer's point of view, service-user experience increases

2.2. Concept of Service Design

The quality and sustainability of service are affected by the loyalty and emotional connection it develops with its users [10]. However, it is difficult to form emotional connections with users because of the "delivery gap" that tends to appear between service providers' intentions for their service and users' perceptions of the service experience. This gap originates from the complexities and perplexities inherent in-service experience [10,24–26]. As service experience comprises multiple factors, including particular circumstances, personal reactions, and the surrounding environment, it is difficult to identify the root cause of a delivery gap. However, owing to the need to overcome problems and to design a holistic user experience for the service-provision process, many choose to base their service design on service-dominant logic [25] (see Figure 1).

Nowadays, service design is gradually being applied to many social issues and challenges [27,28]. Further, several studies [29–32] have discussed the application of service design in public service innovation, such as in the British NHS (National Health Service) Medical System, the American Kaiser Permanente, and the Japanese Emergency Medical System [14]. Moreover, as the economization of services rapidly progresses, it is increasingly applied to all industries as a methodology for upgrading services [33]. For example, in the field of academia, the definition of service design slightly differs from that used in industry; nevertheless, commonalities can be found in the following areas: (1) it follows a design-thinking process, which involves seeking alternatives through collecting and sharing ideas; (2) it intensively analyzes the relationships between stakeholders and encourages them to make interventions; (3) by employing a comprehensive research method, it visualizes the tangible and intangible services that customers experience, and uses this to improve customers' experience value. Regarding service design-related activities, Table 2 shows the main characteristics of management consulting and service design, while Table 3 presents the chief characteristics of product design and service design. Here, it is notable that there is a paradox within the elements of the service design property, as it states that service is "invisible" and "intangible", yet "able to present visual results". Considering this, service design caould be defined as a holistic problem-solving journey that involves interpreting intangible problems as visible phenomena and overcoming them.

Based on the aforementioned studies and definitions, the following could be considered the distinctive characteristics of service design methodology: (1) the foundation is "design thinking", which is a creative problem-solving process [33–41]; (2) the ultimate goal is "user experience value" [11,42–45]; (3) the practical research method is "participatory design" [3,46]; and (4) the key research scope is "the interface between users and providers" [47–49].
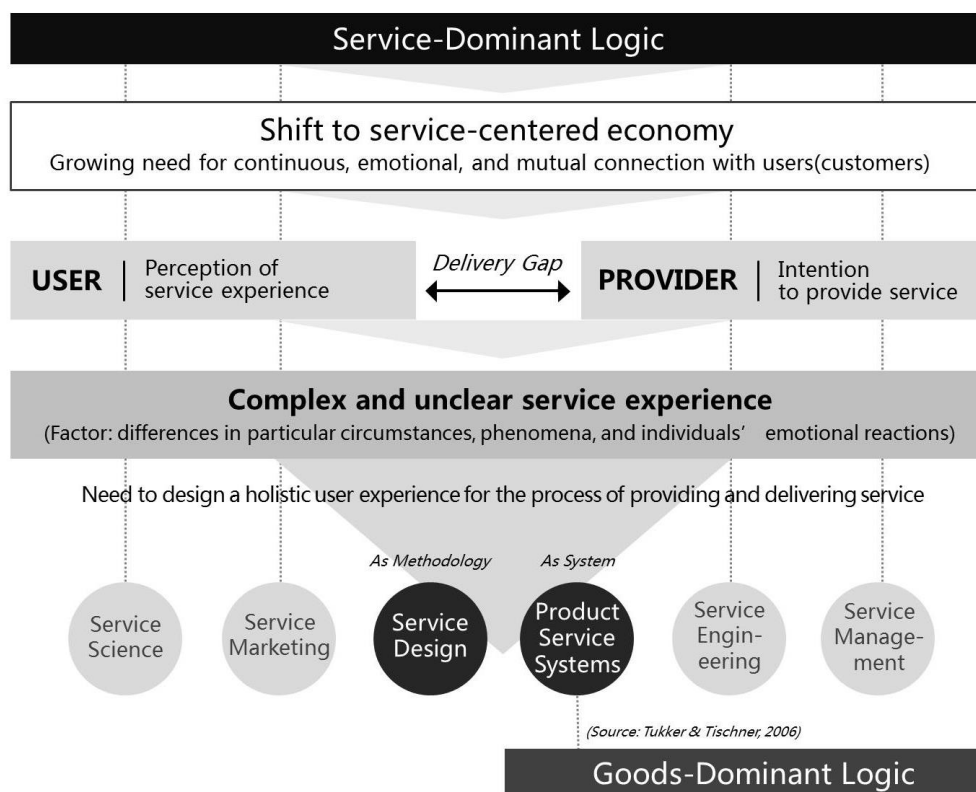
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Figure 1. Background of the emergence of service design (Source: Tukker and Tischner [50]).

Table 2. Comparison of the characteristics of management consulting and service design.

Management Consulting	Division	Service Design
Company-centered	Focus	Balance between company and customers
Obtaining a competitive edge through selecting and concentrating on business resources and improving efficiency	Point of view	Discovering customers' potential needs and stakeholders' desires / Standardization
5Forces Model (Porter, 1979) 3C analysis (Ohmae, 2005) BPR (Davenport, 1990) 6 Sigma (Harry, 1987)	Tools	Customer observation, storyboard, persona, customer journey map, service blueprint, etc.
Logical Thinking	Way of thinking	Design Thinking
Report (need for additional development to conduct application)	Result	Visualized report (instantly applicable result)

Table 3. Comparison of the characteristics of product design and service design.

Product Design	Division	Service Design
Possible to check visually	Visibility	Impossible to check visually
Users' perspective (experience, usability)	Perspective	From the perspective of the user/provider/community
Physical goods, including products	Target	Broad range, including service/system/institution
Design that focuses on visual representation	Expression method	Design that focuses on emotional experience
Tangible	Tangibility	Intangible

3. Distinctive Nature of Service Design Methodology

3.1. Creative Problem-Solving Process: Design Thinking

There are conceptualizations of design thinking; for example, it has been defined as the "transfer of the organization's design philosophy into design activities and outputs" [51,52] or a set of formal design methods necessary for finding, brainstorming, and prototyping [52,53]. These diverse

conceptualizations of design thinking still co-exist [52,54–57]; however, it is generally perceived as a creative method of problem-solving. Buchanan [37] highlighted the usefulness of design thinking for solving wicked problems, referring to it as a new way of thinking that could help advance human sciences. Moreover, Dziersk [40] defined design thinking as a repeatable process employing unique and creative techniques which yield guaranteed results, while Lockwood [58] argued that it provides an entrepreneurial mindset and paradigm to people and organizations that engage in projects. Further, Mager [33] described it as a creative problem-solving method that incorporates diverse aspects and allows users to continually make improvements to company structures, strategies, and projects. Aside from these views, design thinking has also been described as a tool that improves previous methodologies through exploration and expression [59], and as a strategy for visualizing problems and seeking timely solutions [39]. One of the most cited and precise definitions of design thinking is given by Brown [35,36,60]: "Design thinking is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity".

In the field of educational practice, Androutsos and Brinia [34] asserted that design thinking "leads students—through an artful and experiential way of thinking and doing—to be much more creative and innovative" as well as "more responsible by allowing them . . . ownership of the creation process". Different elements of the application of design thinking are mentioned in the literature: mindset, team, diversity, process, tools, and environment [35,36,41,53,59,61–66]. Brown [36] presented the following three stages of design thinking methodology: inspiration, ideation, and implementation. In the style of design thinking advocated by Stanford—which follows the order of empathizing, define, ideate, prototype, and test—the testing and revising of ideas is repeated until an optimal result is derived, which designers recognize by using their sensitivity and intuition, as well as various research tools.

In the marketing field, design thinking is perceived as a series of paradigms for improving business. According to Martin [41], using design thinking as a strategic tool is the most suitable method for business management, as it allows administrative minds and creative ideas to co-exist (see Figure 2). Design thinking generates creative ideas by harmoniously converging logical and analytical thinking with intuitive thinking, without manipulating the mind [38]. In addition, it outperforms the general verification method because of its abductive reasoning that combines the merits of deductive and inductive logic; moreover, it pre-establishes the inclusive inference concept that "it could be anything" and looks for solutions through logical inference [41]. The reason for its good performance in this regard is that new ideas or insight cannot be proven prior to the occurrence of a problem and can only be justified after the actual occurrence (see Table 4). The design-thinking approach to problems facilitates an accurate definition of the problem to be solved; in other words, it allows fundamental access to problems. This is useful for deriving user-empathetic solutions in domains where a clear identification of problems is difficult, which could be the case with complex social agendas.
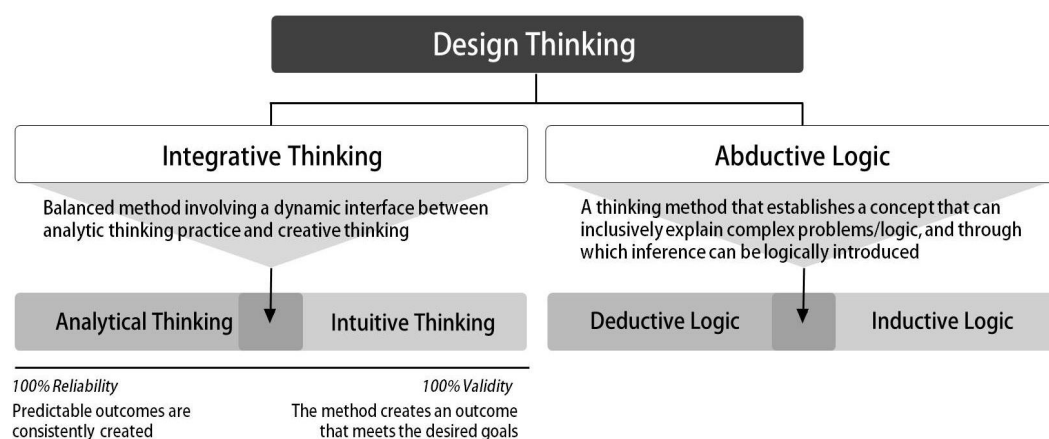

Figure 2. Martin's [67] concept of design thinking.

Table 4. Comparison between logical thinking and design thinking.

Logical Thinking	Division	Design Thinking
Hypothetical/Top-down	Inference method	Inductive/Bottom-up
Quantitative	Research method	Qualitative
Data	Analysis target	Story
Information	Derived result	Insight
Popular (issue)	Problem origin	Fundamental (human)
Expertise	Approach	Empathy
Instruction	End goal	Innovation

3.2. Ultimate Goal: User Experience Value

In marketing and design, the experience is an important concept for understanding users. In "The Entertainment Economy", Wolf [68] stated that the age of tangible and physical products has shifted to the age of entertainment experience and hands-on experience; additionally, Schmitt [69] asserted that the highest criterion for customers to judge a certain brand is the level of satisfying experience they receive in regard to the service, brand, and design in question [11]. Pine and Gilmore [70] emphasized that companies should endeavor to provide unique user experiences by distributing products and services that are differentiated from those of their competitors. Meanwhile, Hassenzahl and Tractinsky [42] explained that user experience depends on users' internal conditions, such as their tendencies, expectations, motivations in a series of circumstances, and systems; in contrast, experience in design concerns "value and satisfaction for users". Shedroff [44] considered users' general experiences regarding consumption to comprise a sensory interface of thje product, system, and service, through which a person has experiences on both physical and cognitive levels; further, he also emphasized the importance of widening users' experiences by providing them with optimal environments. Norman [71] described user experience as the ultimate value provided to users, including all sensory processes that a user undergoes while using products and services. Therefore, the interface between a user and his or her environment influences the user's experience. Figure 3 illustrates the concept of user experience in these two domains.
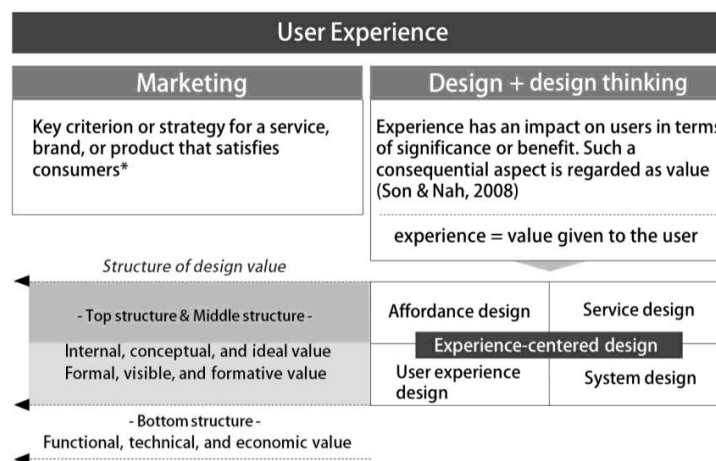
Figure 3. Comparison between marketing and design in terms of user experience.

User experience in service design refers to the emotional property of service created at user touchpoints, which can be considered to represent the moment users encounter products outside of the product environment [72,73]. Using a four-stage user experience model, Roto, Law, Vermeeren, and Hoonhout [43] classified the characteristics of user experience over time as follows: anticipated user experience, momentary user experience, episodic user experience, and cumulative user experience (see Figure 4). Of these, the most important stage is "momentary user experience", which manifests in a collection of subtle changes in emotions at the moment a service is encountered [74]. Once service experience is acquired, when the next momentary service experience occurs, the user's emotion

instantly changes based on an external stimulus, such as the service provider's attitude, language type, or facial expressions; Russell [75] described such changing emotions as "circumflex of emotions" [76] (see Figure 5). According to him, the entire range of subtle and mysterious emotional changes that a user experiences at various moments when receiving a service appears to be complicated and unclear when the interface of the user and their environment is considered. This is the reason that service design is considered to have the characteristics of "holistic experience design", transcending customer experience design.
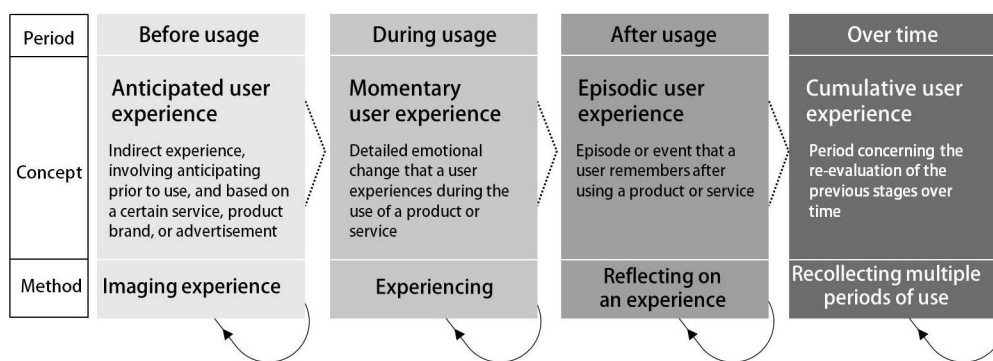

Figure 4. Roto et al.'s four stages of user experience (2010, p. 8).
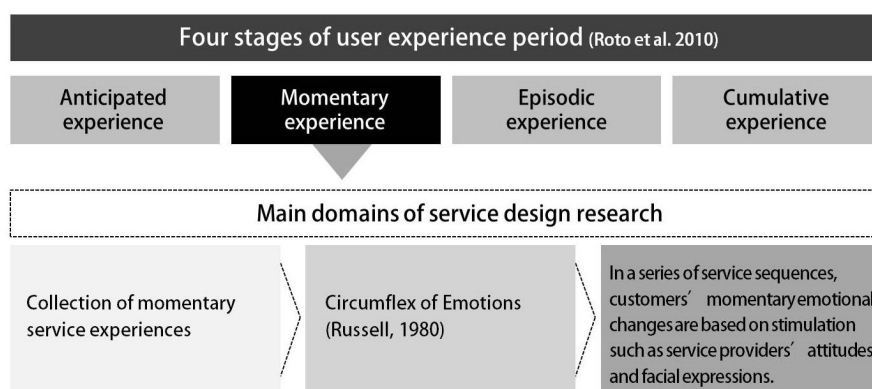

Figure 5. Service design domains based on users' experience periods.

3.3. Practical Research Method: Participatory Design

Participatory design includes research, projects, and systems in which users actively participate during the service design process [77]. This participatory design is similar to Rittel's [3] participatory design process because it uses visual tools for problem-solving, and encourages democratic discussion and collaboration based on multi-disciplinary collaboration and mutual understanding (see Figure 6). The characteristics of service design, such as contextual and multi-disciplinary research and co-creation, are based on this form of participatory design (see Figure 7); this is because service design requires a flexible environment in order to adjust to spatial and temporal limitations, as well as to the unexpected behaviors and opinions of stakeholders during the research process, where in-depth user observation takes place. This participatory design is closely related to open innovation. According to Silva and Leitao [78], innovation is not something intermittent that happens by chance, nor is it something resulting from the action of a single agent. Kline and Rosenberg [79] insist that innovation is the result of an interactive process between the firm and their surrounding environment. For Dahlander and Gann [80], the interaction between organizations is fundamental, since no organization can innovate in isolation and must connect with different partners in order to acquire ideas and resources from the surrounding environment, namely, new ways to access talent, new results from intellectual property, innovative technology to license or spread, or even new forms of collaboration on different geographical

bases [81]. These views are based on the fact that open innovation takes place when various factors in the environment, including users as well as stakeholders, are actively involved in the problem. In addition, it explains the close relationship between participatory design and open innovation.

In the context of open innovation, Leitão [81] presents a business model entitled: Open innovation bridge-Tangram model, the ultimate goal of which is to renew business innovation capacity. This business model consists of internal factors (A1), linking factors (A2), internal R&D activities (B3), external R&D activities (B4), strategic competition (C5), critical elements of transactional structure (D6), and business innovation capacity (E7). The Tangram model identifies the critical elements of the transitive structure of open innovation business models. Hence, this study will consider the resources of this model in the problem-solving service design platform model.

Figure 8 shows an example of a participatory design project called project [RED] [46], which was an endeavor to create a public service project in the UK. In summary, "participation" in problem-solving is related to user value. In particular, participatory design in service design is an activity that creates mutually shared value, as it involves collaborations with experts and stakeholders that transcend the active participation of users. In other words, it is the most advanced form of problem-solving for users, in that users do not stop attempting to solve the problem once they are satisfied with the unilateral service, but instead try to discover the essence of the problem by analyzing the internal movement.
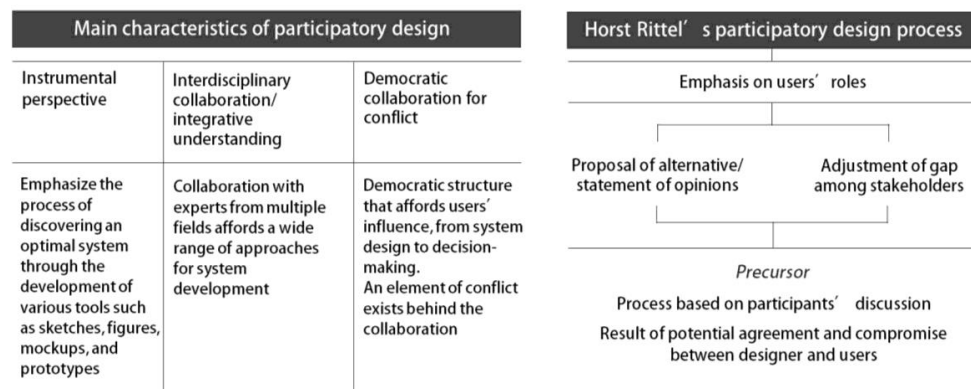

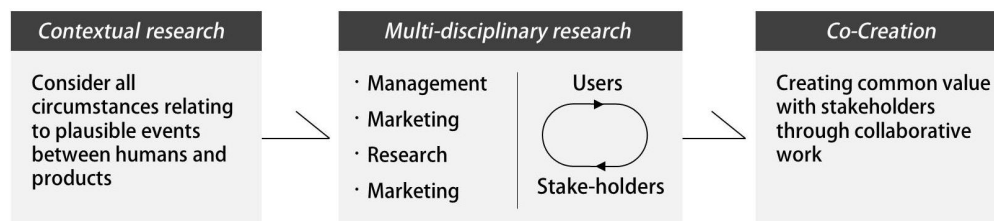**Figure 6.** Comparison between participatory design and Rittel's participatory design process.

Figure 7. Concept of participatory research in service design.

Step 1 Diagnosis	Step 2 Co-discovery	Step 3 Co-design	Step 4 Co-development	Step 5 Solution
Gauging the scope of project. Diagnosing the nature of the opportunity	Obtaining a full understanding and the participation of the local community. Developing customized methodology and tools for individual issues	Designing and testing the shared ideas	Deriving a new result	Establishing the optimal solution
Understanding the issue and problems through conversation and collaboration with the designer and local community		Presenting an idea obtained in a previous stage. Gaining the participation of the local community	Developing a problem-solving prototype, visualizing the solution, developing mockups	Developing, through user testing, a service that provides sustainable, financial value

Figure 8. Example of user participation in project [RED], a public service project in the UK.

3.4. Scope of Key Research: Interaction between Users and Providers

Service design concerns all service-related phenomena that involve interactions between users, providers, and stakeholders within the service domain. Therefore, subtle changes in emotions that occur while providing services are also a research target. This is because emotional feedback between users, providers, and stakeholders over numerous touchpoints could influence the quality of the service and eventually determines the user experience value [49] (see Figure 9). Bitner [47] described the interface between service users and providers as the main criterion for service evaluation. Further, after considering the action of implementing service within service environments, Bitner, Ostrom, and Morgan [82] classified service into self-service, interpersonal service, and remote service. In addition, Chang [48] stated that exchanges within holistic service systems occur in two ways: between the service user and the provider, and between the service environment and service experience. At this point in the process, the service provider implements the service-delivery process, while the service environment utilizes products, tools, techniques, physical locations, etc. as mediums of mutual exchange. Users evaluate the quality of service and the level of satisfaction by considering the service process and the physical environment provided by the service providers; thus, the interface between the service user and provider is a key research area in that it influences users' holistic service experience value.
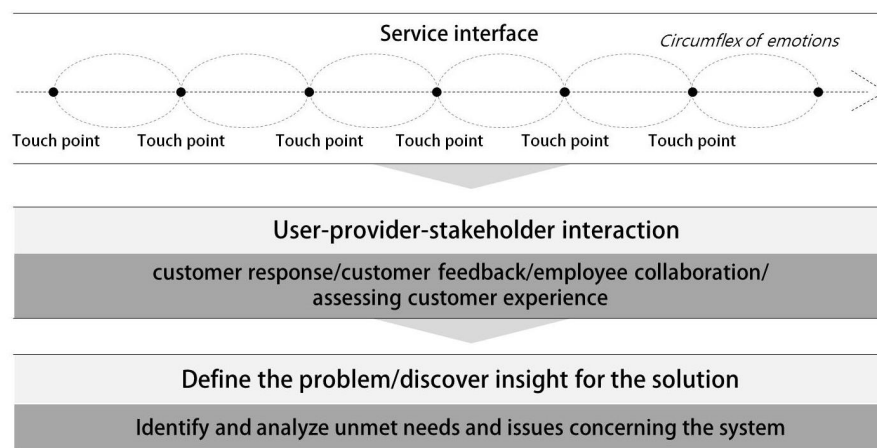

Figure 9. Interaction between user and provider at service-user touchpoint.

4. Characteristics of the Service Design Process

Most problems addressed through service design relate to the domains in which the subjective perceptions of humans intervene to a significant degree. Thus, the processes established by the design industry and academia slightly differ from each other. However, there is some commonality, in that user experience is improved through a repeatable process of collecting and dispersing ideas depending on circumstance. Table 5 shows a list of the main processes that could be summarized into three steps: (1) careful observation of user experience; (2) visual design of services; and (3) presentation of service components and models (see Figure 10). Step 1 entails interviewing stakeholders and analyzing the service-delivery environment and process to establish the goal of the project; Step 2 concerns understanding the flow of customer service at each service touchpoint and developing related ideas; and Step 3 involves developing the discovered idea into an actual prototype and completing a final manual. The significance of this process lies in developing a system that is beneficial to user experience rather than focusing on determining the value of goods. In other words, the service design process is a continuous effective record that builds on "momentary user experience" and entails a process of transforming perception and behavior into solutions to problems. On the one hand, the analysis of the process of PPS development was carried out considering the four-phase conventional design process proposed by Hubka and Eder [83] and Pahl and Beitz [84] as a reference scheme and, as shown Table 5,

consisting of the following phases: Ideation and Task Analysis, Conceptual Design, Embodiment Design, and Validation and Release [85].

Table 5. Comparison of the major service design and PPS (Product-Service Systems) design model processes.

| Division	Model (Company)	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
Author summary	British Standards	Business development	Service design development	Assistance for providing service	Service operation and optimization	
	Design Council	Discover	Define	Develop	Delivery	
	Live Work	Insight	Ideas	Prototype	Delivery	Specifying
	Engine	Identify	Build	Measure		
	IDEO	Observation	Brainstorming	Rapid Prototype	Refinement	Implementation
	Design Thinkers	Discovering	Conceptualizing	Designing	Building	Implementing
	Spirit of Creation	Discovery	Generation	Synthesis	Enterprise	
	Framework for PSS design for manufacturing firms		Conceptual design		Validation & release	
	Innovative product advanced service systems framework			Embodiment design	Validation & release	
Haber & Fargnoli, 2017 [85]	Customization framework for road-mapping PS integration			Embodiment design	Validation & release	
	Business model design methodology for innovative PSSs		Conceptual design	Embodiment design	Validation & release	
	Systematic design framework for PSS		Conceptual design		Validation & release	
	Methodology for PSS development			Embodiment design		
	Canvas business model framework		Conceptual design	Embodiment design	Validation & release	
	Practical design framework		Conceptual design			
	Generic competitive process framework		Conceptual design		Validation & release	
	PSS design exploration process				Validation & release	
	Kansei engineered PSS model		Conceptual design	Embodiment design	Validation & release	
	Flexible PSS design framework		Conceptual design		Validation & release	
	Integrated PSS model				Validation & release	
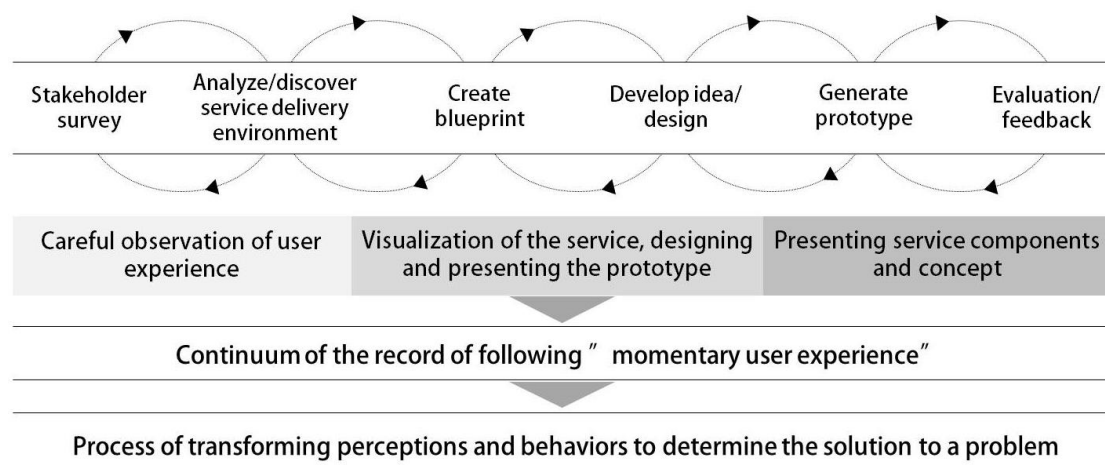
Figure 10. Basic structure of the service design process and its implications.

5. Proposal of the Problem-Solving Service Design Platform Model

A problem-solving service design platform can be proposed based on the distinctive nature of service design methodology, as Figure 11 shows. This model comprises the following six steps: identifying a problem (Recognize), understanding the problem (Discover), deducing the problem (Deduce), defining the problem (Define), solving the problem (Develop), and testing the problem-solving strategy (Deliver). First, the "Recognize" step entails self-realization concerning dissatisfaction and the decrease in the quality of user experience. Second, the "Discover" step involves collaborative and contextual research. Third, the "Deduce" step comprises the discovery of unmet desires by visualizing the current problems. Fourth, the "Define" step encourages creative insight through analysis. Fifth, the "Develop" step consists of designing a service model that reflects the previous findings. Finally, the "Deliver" step checks the feasibility of applying the solution in real-life by analyzing the feedback obtained from the prototype. These steps are associated with the stages of the Tangram model; the steps of "Recognize" and "Discover" could be identified by internal factors and linking factors. The next steps, "Deduce" and "Define", could be accomplished through internal R&D activities and strategic competition. The final stages, "Develop" and "Deliver" can be completed with critical elements of transactional structure and business innovation capacity. The recognition of the problem regarding customer experience and service touchpoint takes place at the touchpoint of 'user experience value' and 'participatory design.' Next, a human-centered problem approach is implemented at the touchpoint of 'participatory design' and 'interaction between users and providers.' Lastly, stakeholders' benefits are created at the touchpoint of 'user-provider interface' and 'user experience value.' When these processes are successfully implemented, participants can understand the problem-solving strategy, validate the usefulness of service design, and grow to trust this methodology, resulting in an improvement in the user experience value, which is the ultimate goal of the project.
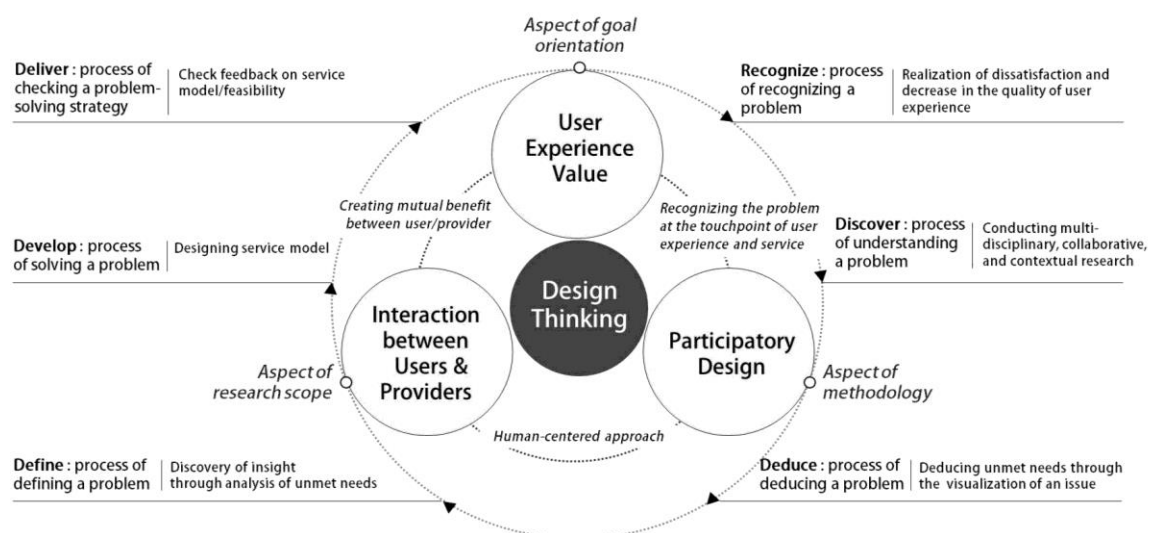

Figure 11. Problem-solving service design platform model: Three-dimensional drawing.

6. Conclusions

The goal of utilizing service design originates from diverse environments and backgrounds, such as the process of producing goods, organization structure, the re-designing of the industry system, and the improvement of public service. However, the primary goal essentially relates to the use of the human-centered problem-solving methodology to improve the user experience value based on design thinking. Through this process, a service designer proposes an optimal solution, designing visual alternatives for obscure problems, and encouraging participants' interventions. Service design is therefore useful to the aspect of human value beyond the perspective of business innovation or economic usefulness. The present study is limited in that it examined previous studies to investigate

the essential characteristics of service design and methodological distinctiveness. Nevertheless, it is significant in its identification of the characteristics of service design that are distinctive from other designs. It went beyond establishing the concept of service design to develop a design platform for problem-solving. A follow-up study will examine the usefulness of the proposed service design platform model by applying it to an actual project. The successful confirmation of the usefulness of this model will have positive implications for the field of service design.

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