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Value Design Method for Digital Innovation

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Abstract

With the evolution of digital technologies such as IoT (Internet of Things) and AI (Artificial Intelligence), opportunities for digital innovation are expanding for all companies, including small and medium-sized enterprises and non-IT companies. However, while many companies can engage in "defensive digital transformation (DX)" by using digital technologies to improve their daily operations, achieving "offensive DX" to create new value in products and services through digital technologies is not easy. We have been developing the "Digital Innovation Design Method" to support offensive DX. This paper presents a new method to further concretize the "value design" of Digital Innovation Design Method. Specifically, while the original value design used the Value Proposition Canvas, the Value Proposition Canvas is generic and difficult for companies unfamiliar with digital technologies to utilize for offensive DX. The method proposed in this paper supports value design considering the characteristics of digital innovation utilizing "Value Graph" and "Digital Value Patterns" in addition to "Value Proposition Canvas" and evaluates its effectiveness through a descriptive experiment with 32 participants.

Keywords: Value Proposition Canvas, Digital Innovation Design, Digital Transformation (DX)

1 Introduction

With the evolution of digital technologies such as IoT and AI, there are significant opportunities for digital innovation not only for large enterprises and IT companies but also for small and medium-sized enterprises (SMEs) and non-IT companies. However, while SMEs and non-IT companies can engage in "defensive digital transformation (DX)" by using digital technologies to improve traditional activities (KAIZEN), it is not easy for them to come up with ideas and business models for "offensive DX" that create new customer value in products and services (Table 1). Additionally, digital innovation requires sharing ideas and business models with many stakeholders and promoting them as an ecosystem. Therefore, a framework and procedures as a common language for sharing and discussing digital innovation are necessary.

Table 1: Defensive DX and Offensive DX

DX Type	Explanation	Examples
Defensive DX	Solving and improving in-house issues using digital technology (KAIZEN)	Process visualization and optimization, work automation, failure prediction
Offensive DX	Creating new customer value for products and services using digital technology (digital innovation)	Remote monitoring and maintenance of equipment, sharing services, autonomous driving

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We have proposed a "Digital Innovation Design Method" that integrates multiple necessary frameworks into a procedure for designing digital innovation [1,2]. This method consists of four phases: "value design," "system design," "strategy design," and "project design." In this method, the value design phase uses the Value Proposition Canvas [3], but the Value Proposition Canvas itself is generic and not specialized for digital innovation. Therefore, it has been challenging for SMEs and non-IT companies, which are not necessarily familiar with digital innovation, to immediately write a Value Proposition Canvas. In other words, a more specific method that supports the creation of the Value Proposition Canvas, considering the characteristics of digital innovation, is needed. This paper proposes a new method specialized for digital innovation in the value design phase of the Digital Innovation Design Method and qualitatively evaluates the effectiveness of the proposed method through descriptive experiments with graduate students.

In this paper, Section 2 presents a review of related works, followed by an explanation of the Digital Innovation Design Method and its associated challenges in Section 3. Section 4 introduces a proposed method to address these challenges. The results of the descriptive experiments are discussed in Section 5, and finally, Section 6 concludes the paper.

2 Literature Review

The Business Model Canvas (BMC) [4] and the Business Model Navigator [5] are well-known frameworks for new business models and are widely used. These are general frameworks and are not specialized for businesses utilizing digital technologies. Therefore, various extensions of the BMC specialized for digital business models have been proposed. Research on BMC extensions for IoT includes proposals by Dijkman et al. [6] and Ju et al. [7]. Dijkman et al. [6] extracted the components of the BMC that are characteristic of IoT applications. For example, "convenience/ease of use," "task completion," "performance," "upgradability," "comfort," "price," "novelty," and "brand/status" are important items in the VP (Value Proposition) of the BMC for IoT. Ju et al. [7] compared seven IoT business models from past literature, organized common items, and proposed a BMC specialized for IoT services. Furthermore, they conducted case studies on companies in three industries—Google (smart consumer electronics industry), GE (industrial internet industry), and Car2Go (transportation industry)—to verify the proposed IoT business model items. Arnold et al. [8] proposed three industrial IoT business models based on the BMC: cloud-based business models, service-oriented business models, and process-oriented business models. Additionally, designing digital business models is challenging with just a framework, and it is effective to refer to cases described in the framework. Furthermore, extracting design patterns from business model cases makes it easier to consider business models. Uchihira et al. [9] analyzed and organized 50 specific examples of IoT business model canvases and demonstrated the patterns of IoT business model canvases and their application to business model design.

Companies have also proposed methods for designing digital business models. SAP's Business Model Development and Implementation (BMDI) method uses a framework consisting of the Business Model Canvas (enterprise view representation) and Network View Representation, and involves four types of iterations [10]. Additionally, when applying the BMDI method to digital business, it presents Digital Key Elements (Data, Cloud, People, Business, Things) and Digital Value Drivers (such as On-demand service, Micro-segments, Networked customer relationships) to support ideation using digital technologies [11]. The business model innovation method proposed by Germany's Evonik uses a modified version of the Business Model Canvas called the

Business Model Innovation (BMI) framework, which constructs new business models from traditional ones in five steps [12]. A key feature here is the creation of ideas using data as a key resource. Furthermore, the relationships between the blocks of the Business Model Innovation (BMI) framework are linked as Digital Business Model Innovation Loops.

The various digital business model design methods mentioned above each have their own characteristics. However, the Digital Innovation Design Method [2], which will be explained in detail in the next chapter, is unique in that it consistently designs from value design to project design. On the other hand, there are some insufficient aspects regarding value design, and this paper proposes enhancements to address those aspects.

3 Digital Innovation Design

This section explains the overview and challenges of the Digital Innovation Design Method [2] that we have developed. This method is a procedural approach that combines the Business Model Canvas (BMC) with multiple frameworks and is used in the planning stage (conceptual design) of digital innovation. This method can be utilized as a tool for organizing the proposer's thoughts and facilitating communication and discussion among stakeholders. It is specifically designed for companies that are new to digital innovation, offering a straightforward method that can be effectively learned within a one-day training session.

This method consists of four phases: value design, system design, strategy design, and project design (Figure 1, Table 1). In each phase, in addition to the BMC, frameworks such as the Value Proposition Canvas, SCAI Graph, Open & Closed Canvas, and Project FMEA (Failure Mode and Effect Analysis) are used.

In the first phase (value design), the Value Proposition Canvas (Figure 2) is used to clarify the customer and the value provided. In the second step (system design), the SCAI Graph (Figure 3(b)) is utilized to describe the architecture for value realization through IoT and AI technologies. In the third step (strategy design), CVCA (Customer Value Chain Analysis) and the Open & Closed Canvas (Figure 3(c)) are used to outline strategies for collaboration with partner companies and ecosystem building when promoting digital businesses. These results are ultimately integrated into the BMC (Figure 3(a)). It should be noted that the SCAI Graph and the Open & Closed Canvas are frameworks we have originally developed. In the final step (project design), a project implementation scenario is formulated, potential risks during implementation are identified and analyzed, and countermeasures are considered using Project FMEA [13,14] (Figure 3(d)). The challenges of digital innovation can be patterned from past cases, and by comparing these patterns with the target project, risks can be anticipated. Traditional business model design methods do not include project design, but by reconsidering value design, system design, and strategy design with risk in mind, the probability of success can be increased.

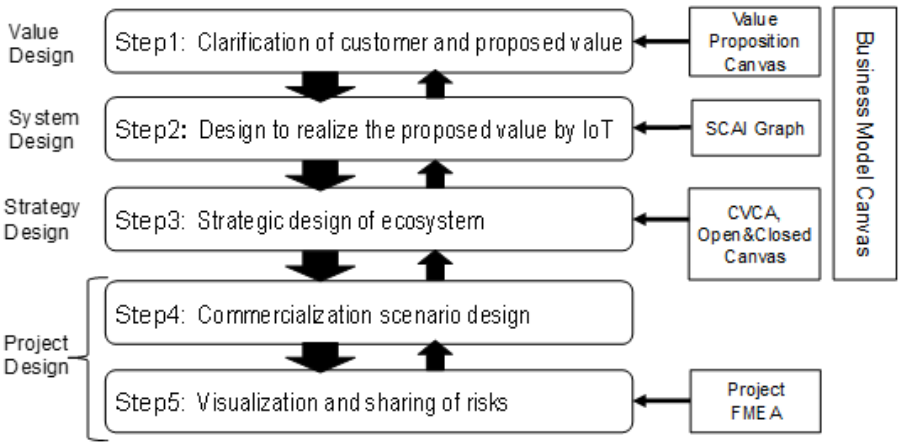

Figure1: Digital Innovation Design Method

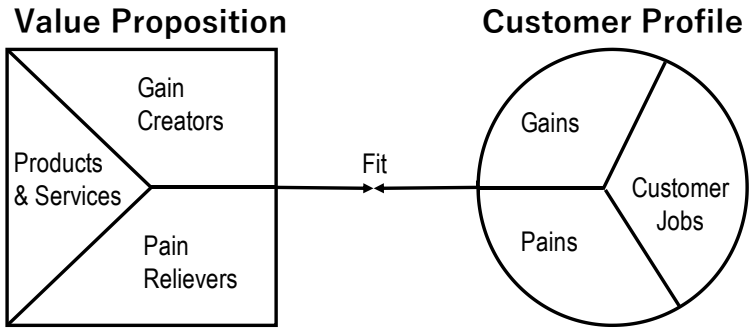

Figure2: Value Proposition Canvas

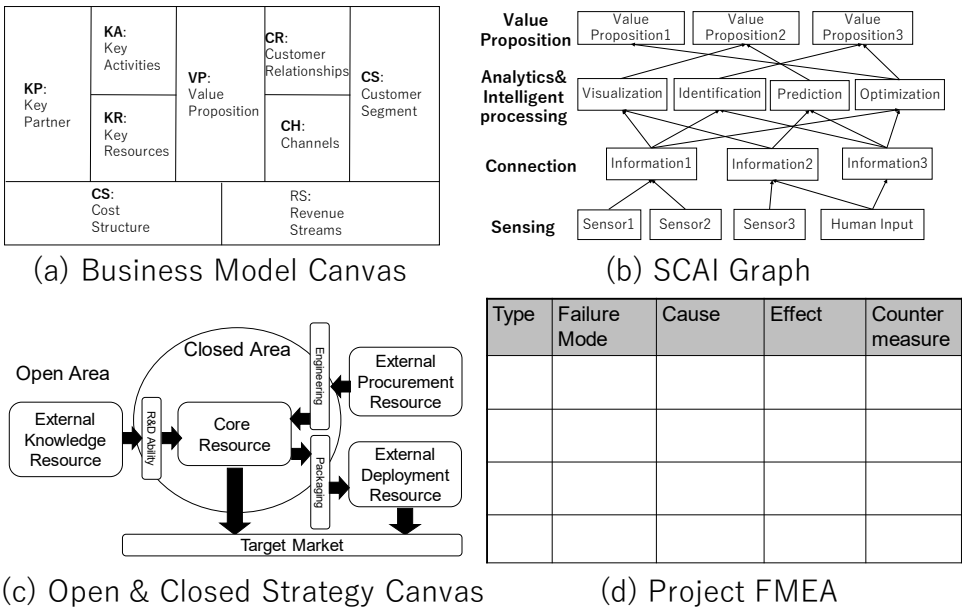

Figure3: Frameworks in Digital Innovation Design Method [2]

By using these procedures and frameworks, it is possible to visualize the opportunities and challenges of digital innovation, achieve a common understanding among many stakeholders, conduct appropriate discussions and decision-making, and build the concept (proposal) of digital innovation without relying on individual abilities or experiences.

However, although the design procedures and simple frameworks offer convenience, they can pose challenges for designers who are not well-versed in digital innovation. Therefore, it is essential to enhance the method to provide more comprehensive support for each phase of the Digital Innovation Design Method. This paper focuses on refining the value design phase, which is particularly important.

4 Proposed Method

4.1 Deficiencies and Extensions of the Original Value Proposition Canvas

In the value design of the Digital Innovation Design Method, the Value Proposition Canvas is used. The Value Proposition Canvas consists of the Customer Profile and the Value Proposition, and it is utilized to clarify what value is proposed to whom. In Customer Profile, the jobs that the customer is trying to accomplish are listed as "customer jobs," and by organizing the "pains" (problems) and "gains" (desires) associated with these jobs, the target customers are represented. On the other hand, in the Value Proposition, the combination of products and services proposed to the customer is listed under "products and services," and by showing how these alleviate the customer's pain (Pain Relievers) or achieve their gains (Gain Creators), the specific methods of value proposition are expressed. By enhancing the alignment between the Customer Profile and the Value Proposition in this way, it becomes possible to design value propositions that meet customer needs. However, the Value Proposition Canvas is a general-purpose framework and is not specifically tuned for digital innovation.

The design of the Value Proposition Canvas has three steps.

- Step1 (Developing and defining opportunities): Discovering customer jobs in the Customer Profile.
- Step2 (Identifying needs from the customer's point of view): Fill in the pain and gains in the Customer Profile.
- Step3 (Answer the needs with digital technology): Devise the content of the Value Proposition based on the Customer Profile.

In the value design of the Digital Innovation Design Method, it is necessary to clarify "what kind of value will be created by digital technology," but the following two points are deficiencies of the original Value Proposition Canvas for digital innovation design.

- Deficiency 1: Digital innovation needs to create new customer value. In this case, in Step 1 and Step 2, the extraction of traditional customer jobs and their pain gains may improve traditional jobs, but will not lead to the creation of new customer value.
- Deficiency 2: In the conventional Value Proposition Canvas, there is no perspective on how to solve customer pains and realize gains through digital technology.

The proposed method makes the following two extensions to solve the above two deficiencies.

4.2 Expansion to Eliminate Deficiency 1

In the value design phase, ideas for creating value through digital innovation is proposed. Here, the method must enable the conception of value that responds to changes in society (customers and markets) and leads to a competitive advantage through digital innovation.

Christensen et al. propose Jobs Theory (Jobs-to-be-done framework) [15], emphasizing that to generate innovation, it is crucial to clarify the causal relationship of why customers purchase a product or service and to discover the essential tasks (jobs). Jobs Theory explains that customers "hire" products or services to perform Jobs-to-be-done that arise in their lives. By applying the concept of jobs, existing products and services can be re-evaluated based on their fundamental purposes, allowing for a deeper exploration beyond mere incremental improvements. This implies that by identifying and analyzing the jobs (Jobs-to-be-done) of existing products and services, new value opportunities can be uncovered and recognized.

Christensen et al. [15] do not propose a concrete framework for the job discovery process in Jobs Theory. Hence, we use Value Graph [16] (Figure 4), a method from value engineering that visualizes the essential purposes and functions of products and services. Value Graph clarifies the essential purposes (WHY = jobs) of products and services and breaks down the functions (HOW) to achieve these essential purposes.

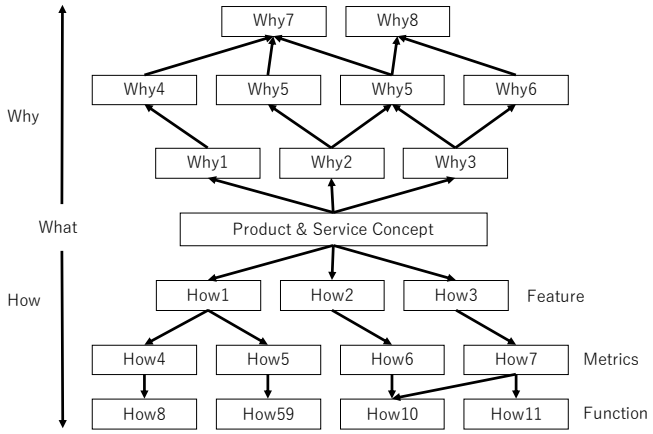

Figure 4: Value Graph [16]

4.3 Expansion to Eliminate Deficiency 2

At this phase, it is sufficient to provide materials to think about what kind of products or services using digital technology can realize customer value. Additionally, if the process is rigid and inflexible, it may narrow the scope of discussion and ideas, and there is a risk of falling into a technology-first mindset. Therefore, it is desirable to show patterns of how digital technologies can be used to realize customer value. In this study, we use the value provided to customers through digital technology based on advanced examples from Nomura Research Institute (Digital Value Patterns) [17]. Specifically, it is categorized into three areas: "enhancing consumption and usage experience value," "reducing costs and usage barriers," and "creating a sense of security and trust," and shows specific methods of implementation using digital technology (Table 2).

Table2 Digital Value Patterns [17]

A: Enhancing Consumption and Usage Experience Value

Digital Value	Implementation
Tailored to individual preferences	Mass customization
Usable anytime, anywhere	Mobile apps
Usable without waiting	Process automation, self-service, on-demand provision
Usable as many times as desired	Content subscription
Usable quickly and reliably	AI/IoT solutions

B: Reducing Costs and Usage Barriers

Digital Value	Implementation
Free or low-cost use of products or services sold at fixed prices	Freemium
Automation of service delivery processes	Pay-per-use
Eliminates the hassle of finding cheaper sellers	Price comparison information, cost transparency
Purchase products or services at a price you are willing to pay	Auction
Purchase expensive products or services at a lower price when bought in bulk	Volume discount
Reduces the hassle and time of payment	Subscription, automatic billing
Avoid paying intermediary costs	Direct sales model
Reduces costs associated with tasks and operations	Operational automation

C: Creating a Sense of Security and Trust

Digital Value	Implementation
Safely use previously unknown products or services	Marketplace
Make objective decisions based on data	Data analysis platform
Perform tasks and operations with speed and quality	Development platform, service platform
Recognition by previously unknown people	Social networking services (SNS)

4.4 Details of the Proposed Method

We propose a value design method for digital innovation that integrates the two previously mentioned extensions, as illustrated in Figure 5. This section explains the proposed method, detailing the extensions to the Value Proposition Canvas and the corresponding procedures step by step.

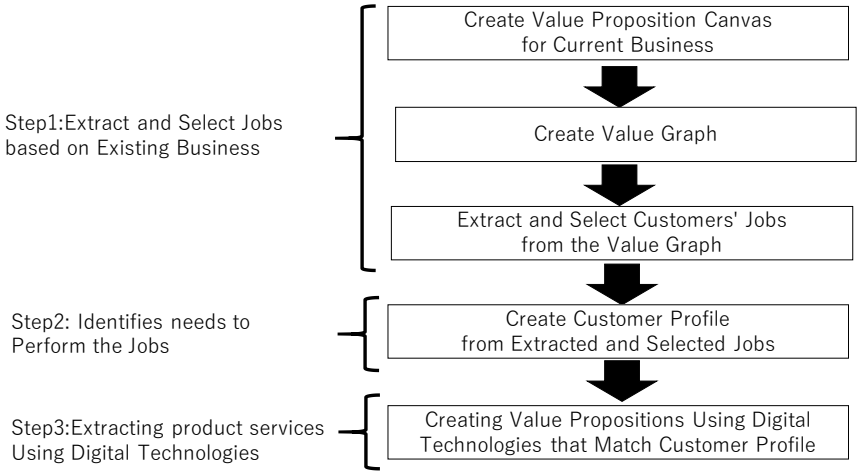

Figure 5: Value Design for Digital Innovation

Step1 ： Construct value graph based on existing business

Step1-1: Create Value Proposition Canvas of existing business

To extract jobs, first describe the current Value Proposition Canvas for the business targeted for transformation through digital technologies. This helps deepen the understanding of the current customers and value propositions.

Step1-2: Create Value Graph

Next, based on the content entered in the Value Proposition Canvas, repeatedly ask why the product or service is necessary for the customer and what its ultimate purpose is. Using the Value Graph, visually structure the value currently provided to customers within the business. When asking "why," it is essential to consider not only functional aspects but also emotional and social dimensions. This approach helps to visualize the situations in which customers seek progress in their lives and identify the underlying jobs-to-be-done.

In this method, after creating the upper part of the Value Graph, the lower part is systematically filled in. The first tier, labeled as "features," represents the essential functions of the product or service. The second tier, "metrics," captures how these attributes are perceived and evaluated by the customer. Finally, the third tier, "functions," details how the product or service delivers the means to achieve these attributes. This structured approach ensures a comprehensive understanding of the value provided.

By comprehensively analyzing both the upper and lower parts of the Value Graph, the designer can refine and enhance the overall product or service concept, as well as further consider the upper part of the Value Graph.

Step2 ： Identifies needs to perform the job

Create the Customer Profile in the Value Proposition Canvas from the Value Graph. First, extract and select jobs from the upper part of the Value Graph. Then, set the extracted and selected jobs as Customer Jobs to create the Customer Profile. When filling in the Pains and Gains, it is important to consider not only the functional aspects but also the emotional and social aspects of the

needs, such as what the customer is looking for and what they are struggling with while performing the job.

Step3 : Extracting product services using digital technology

Based on the content of the Customer Profile, the content of the Value Proposition in the Value Proposition Canvas is devised. The products and services can be conceived using the upper and lower parts of the Value Graph created in Step 1, specifically the connections of purposes at the top that were the basis for the extracted and selected jobs, as well as the "functions" listed at the bottom of the Value Graph. Additionally, the Digital Value Patterns from Nomura Research Institute can be used as materials (Table 2). The Digital Value Patterns can be applied to the Pain Relievers and Gain Creators in the Value Map, as well as to the products and services. Therefore, by finding Digital Value Patterns that can serve as Pain Relievers and Gain Creators and incorporating the implementation methods into the products and services, it is possible to connect customer needs with digital technology. Once ideas for the products and services to be proposed to the customer are obtained in this way, the content is refined, and the Value Proposition Canvas is completed.

5 Evaluation and Results

5.1 Evaluation Method

The effectiveness of the proposed method is evaluated through descriptive experiments. In these experiments, a comparison is made between the conventional method (using only the Value Proposition Canvas) and the proposed method (using the Value Proposition Canvas + Value Graph + Digital Value Patterns). The evaluation focuses on two points: (1) whether the participants understood DX in a fundamental rather than superficial way and worked accordingly, and (2) the relationship between their work and the proposed method. In other words, since the evaluation of the output (Value Proposition Canvas) of each method depends on the participants' abilities regardless of the process, the effectiveness is confirmed through a qualitative evaluation of the value design process instead of the output.

The descriptive experiments were conducted in 32 participants who are JAIST graduate students and native Japanese speakers. They discussed and summarized ideas about the vision and concept of DX using the methods. Subsequently, individual interviews were conducted in separate rooms to clarify the participants' understanding and the factors that influenced it. The case study used was the real-world business of operating gas stations.

A total of eight groups were formed, each consisting of four participants. Four groups utilized the conventional method, while the remaining four applied the proposed method. The design of the descriptive experiments carefully considered factors such as the participants' understanding of DX and ensured uniform conditions across both the conventional and proposed methods.

The interviews were analyzed to clarify the participants' understanding of DX and the tendencies observed in each group using the different methods. The factors and the influence of each method were analyzed based on the progression of the group work. The qualitative data analysis tool MAXQDA was used for this series of analyses.

5.2 Groups Using Only the Value Proposition Canvas (the Conventional Method)

There were two main tendencies in the progression of discussions. In groups where the direction of the discussion was to think about new services, participants tended to understand DX as an initiative to create value for customers using digital technology, and that it was sufficient to improve and enhance existing services with digital technology. This tendency arose because the items in the Value Proposition Canvas led to the recognition that DX is about creating value for customers, and even ideas conceived from discussions focused on improvements and enhancements through digital technology were seen as creating customer-centric value on the Value Proposition Canvas, where the Customer Profile and Value Map align.

In other groups where the discussion was conducted with the aim of responding to societal changes through DX, participants similarly tended to understand that the goal could be achieved by improving and enhancing existing services with digital technology. Additionally, some participants felt that it was difficult to discuss societal changes and the discovery of new value, and thus they had no choice but to focus on improving and enhancing existing services with digital technology. This led to some participants feeling unsure about what to do regarding DX.

5.3 Groups Using the Proposed Method

Participants in the groups using the proposed method tended to understand DX as an initiative to create new value using digital technology for business development, with the aim of responding to societal changes. Additionally, when considering the value to be created, there was a tendency to understand the importance of questioning why existing services are used by customers and considering their significance in society.

These tendencies were due to the realization of the purpose of DX and the nature of the value to be created during the practice of Step 2 of the proposed method. The series of steps in the proposed method led to the recognition that it is important to consider the value to be created and that digital technology is a means to achieve this. In fact, each group using the proposed method came up with ideas for services that create new value in line with this understanding. An example is shown in Figure 6. This idea envisions a car-sharing service utilizing digital technology, leveraging the location of gas stations (listed as an element at the bottom of the Value Graph) to be used for commuting, shopping, and other daily activities, in anticipation of the future decline in demand for gas stations.

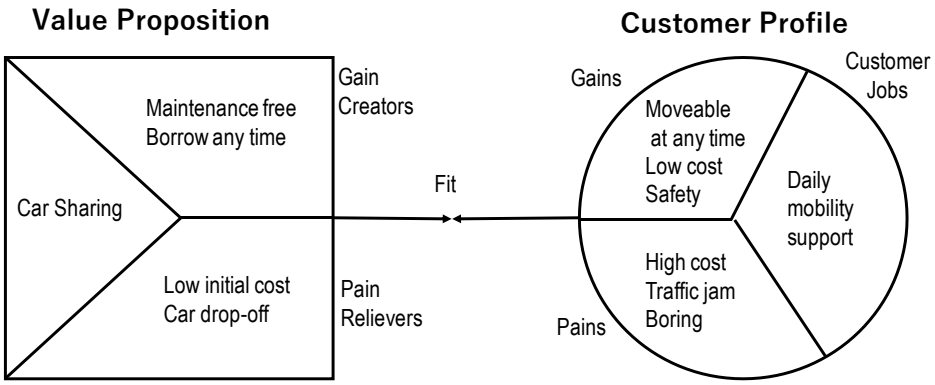

Figure 6: Ideas of a group using the proposed method (example)

5.4 Summary of Descriptive Experiments

The series of analysis results indicate that the proposed method has a desirable impact on forming an understanding of offensive DX, and a clear difference was observed compared to using only the Value Proposition Canvas. Therefore, it is suggested that the proposed method functions well in discussions and is effective in thinking about the vision and concepts of offensive DX. This time, the implementation content of four groups was qualitatively analyzed, but it heavily depends on the participants' qualities. Statistical verification is possible by conducting comparative experiments with a larger number of groups, which remains a future work.

6 Conclusion

This paper presents a method for the value design phase within the Digital Innovation Design Method. With the rapid advancement and widespread adoption of digital technologies, new opportunities are emerging for all companies. However, value design (determining what new value can be created through digital innovation) poses significant challenges for those without expertise in digital technology. This highlights the necessity of the proposed method to support non-experts in effectively approaching value design. The contribution of this paper lies in presenting a concrete procedure and frameworks for value design, along with an evaluation of its effectiveness through descriptive experiment.

In the proposed method, as an idea support for value design using digital technology, we used NRI's Digital Value Patterns list this time, but a more systematically refined digital value patterns list is needed, which is a future challenge. Additionally, based on these lists and corresponding case collections, utilizing generative AI for more interactive designer support is extremely promising, and we are also partially working on this [18].

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