Extraction of Customers' Potential Requirements Using Service Scenario Planning

Kosuke Ota[1], Yusuke Kurita[1], Fumiya Akasaka[1], Koji Kimita[2], and Yoshiki Shimomura[1]

[1] Department of System Design, Tokyo Metropolitan University, Asahigaoka 6-6, Hino-shi, Tokyo 191-0065, Japan
[2] Department of Industrial Management and Engineering, Tokyo University of Science, 1-3 Kagurazaka, Shinjuku-ku, Tokyo 162-8601, Japan
kosuke-ota@sd.tmu.ac.jp

Abstract. The realization of service that adapts to a diversity of customer requirements is becoming important in many industries. A tool for extracting customer requirements, which is called a requirements analysis template, has been proposed previously. However, using this tool, customer requirements are extracted without any consideration of variable environmental factors, such as social change and macroeconomic fluctuations, even though these factors influence customer requirements. This paper proposes a supporting method that service designers can use to help consider such environmental factors and grasp customers' "potential" requirements when they build their service strategies. To achieve this purpose, the requirement analysis template is integrated with scenario planning methodology, which is a method used to consider environmental factors for business strategy planning.

Keywords: Service Engineering, Scenario Planning, Customer Requirements, Environmental Factors.

1 Introduction

As our society matures, productivity improvement in service industries, which account for approximately 70 percent of the developed world's economy and employment, is therefore, becoming a pressing issue. Thus, the importance of service industries is recognizable. On the other hand, in academic fields, many research and development projects are intended to promote the growth of service productivity. Considering this, the authors of this paper have conducted conceptual research on design services from an engineering viewpoint. This type of research is called service engineering [1-2].

In the service design phases, the analysis of customer requirements plays a crucial role because the realization structure of a service should be constructed by starting with each customer requirement. For this reason, a tool for extracting customer requirements, which is called a requirement analysis template, is proposed in service engineering [3]. Using this tool, customer activity is analyzed by using a service

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scenario that describes customer activity with natural language. On the basis of the service scenario, some keywords are extracted from the scenario, and then, customer requirements are identified based on each keyword.

However, the service scenario is described without any consideration of variable environmental factors, such as social changes and macroeconomic fluctuations, even though these factors influence customer requirements.

The purpose of this study is to propose a method of extracting customers' potential requirements. This study focuses on the Business to Business (B2B) industry. Hence, the term "customer" is meant to refer to a "client company" in this paper. To achieve this purpose, the requirement analysis template is integrated with the scenario planning methodology, which is a method of planning business strategies while considering external environmental factors.

2 Previous Studies and the Scope of This Study

2.1 Analysis of Customer Requirements for Service Design

The authors propose a requirement analysis template that extracts customer requirements via a series of templates. The first step of this method is to decide upon a fictitious target customer for the relevant service. Then, information that includes the customers' characteristics is added. On the basis of the information, a story about customer activity in a service delivery process is written in natural language. This story includes information that can be used for decision making in the service design phases. Then, considering the "phase of the service encounter" and "4W1H (what, what like, how, where, when)," keywords regarding the customer requirements are extracted. Finally, each keyword is associated with the required items/quality. Thus, the service designer is able to discover the customer's requirements (See [3] for more details).

This template is applicable to B2B services. The authors previously proposed a requirement analysis method for the strategic improvement of a B2B service and verified the effectiveness of the method by applying it to a real service [4].

2.2 Strategic Planning Method for Decision Making While Considering Uncertainty

Business strategy is significantly impacted by environmental factors, and a business manager faces the difficult task of making decisions while considering potential environmental factors. On the other hand, in the fields of management science, the scenario planning methodology, which is a method for planning business or management strategy while considering environmental factors, is widely applied. In scenario planning methodology, in order to improve the quality of decision making, the environmental factors are extracted, and a story about how the future might turn out is developed. Via this process, managers and employees increase their awareness of business vision. The scenario, in the context of scenario planning methodology, means some futuristic view of the business and a script regarding this futuristic view.

Preparing for future environmental factors is utilized not only in management strategy but also in business and national policy in the fields of global environmental conservation. Thus, scenario planning methodology is applied in various fields.

The concrete procedure of scenario planning varies widely among authors, but the outline is constructed mainly from the following steps. First, the purpose of constructing the scenario is identified (e.g., the goals of the company and the objective of decision making). Next, information related to the business's management is collected, and a driving force is selected: an external environmental factor that will influence future trends. Then, the selected driving force is evaluated in two aspects, namely impact and uncertainty. The impact refers to the significance of the influence, and the uncertainty refers to the difficulty of timing and result prediction. Finally, a scenario is constructed on the basis of the selected driving force.

2.3 Scope of This Study

By using the requirement analysis template, the service designer describes a story that includes a customer's activity in natural language and obtains a customer's requirements from the story. However, in this context, the focus is on a customer's activity regarding "as-is service". For this reason, using the existing framework, some difficulties remain in terms of analyzing customer requirements while considering external environmental factors.

The purpose of this study is to propose a new approach to extracting potential customer requirements related to environmental factors. In order to achieve this purpose, in this paper, requirement analysis methodology is integrated with a scenario construction methodology that is proposed in scenario planning. As mentioned in Section 2.2, scenario planning is a method of constructing a scenario that includes a vision of the future while considering environmental factors. By using scenario construction methodology, the service designer is able to analyze the activity of a client company and environmental factors. On the basis of results of this analysis, the service designer is able to extract a customer's potential requirements.

3 Service Scenario Planning

3.1 Overview of Service Scenario Planning

This chapter introduces an overview of and concrete procedures of a service scenario planning framework that can enable service designers to extract a customer's potential requirements. The service scenario planning framework uses the following five steps, as shown in Figure 1. First of all, the service designer analyzes a client company by using the requirement analysis template mentioned in Chapter 2.1 (STEP 1). In this step, a story about the customer's activity is constructed. In this paper, this story is called a service scenario, and the individual sentences that comprise the story are called the service script. On the basis of this story, a requirement structure is constructed that considers the "goals" of the company and its stakeholders. Next, the service designer collects information about the company, and then, external environmental factors are extracted from the information (STEP 2). Next, the service

designer estimates the impact and uncertainty of the factors that influence customer requirements (STEP 3). The most crucial factor is selected as the driving force. Next, the service designer identifies the service script that is influenced by the driving force, and then, a script that contains an occurrence of the driving force is constructed (STEP 4). Finally, considering the driving force, the customer requirement is identified in the procedure of STEP 1 (STEP 5). The following chapter shows the detailed procedure of this framework.

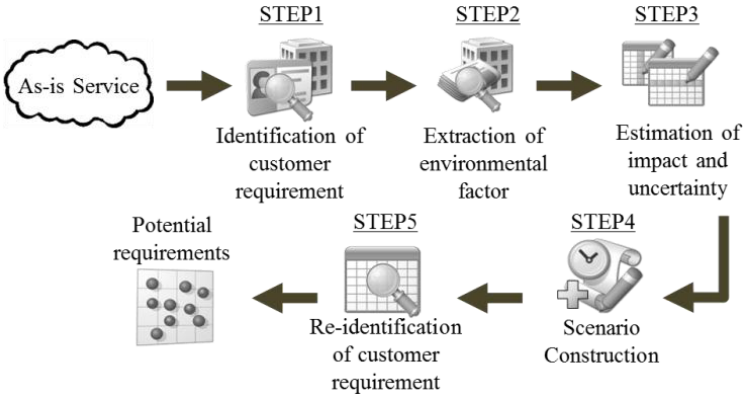

Fig. 1. Overview of Service Scenario Planning

3.2 The Procedures for Extracting Potential Customer Requirements

STEP1. Identification of Customer Requirements
To identify customer requirements, first of all the service designer analyzes the as-is service and constructs a requirement structure. In concrete terms, the "goals," which indicate objectives that should be achieved for each business task, are identified.

Goals
A goal is frequently used to extract requirements in the system design field; it indicates an objective that the system under consideration should achieve.

Based on the collected information, the corporate goals, which is the objective of the company, and the practical goals, which is the objective of the stakeholders, are identified. Furthermore, the practical goals are associated with the corporate goals through the decomposition of the corporate goals. The corporate goals are decomposed into sub-goals and then associated with the practical goals. Next, a service scenario, which is a story about a customer's activity, is written in natural language. From the script written for the service scenario, the service designers identify some "keywords" that can be considered important elements for the service.

Finally, each keyword is associated with the required items/qualities and quality elements. Here, required items refer to what customers want to do, and the required quality is a linguistic expression of customer needs. On the other hand, quality elements work as criteria for evaluating a given quality. In this way, the service designer

obtains the requirement structure of the target client company. An example of a requirement structure is shown in Figure 2.

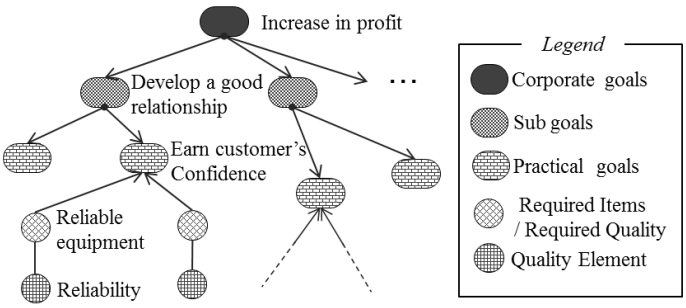

Fig. 2. Relationship among corporate goals and practical goals

STEP2. Extraction of Environmental Factors

In this step, the service designer extracts environmental factors using a "PESTEL (Politics, Economy, Society, Technology, Environment, and Legal)" framework, which is used for extracting external environmental factors. Concretely, first, the service designer collects information about the environmental factors affecting the client company (e.g., the trends of relevant industry segments, national politics, and regulations). Next, from the collected information, the key factors that seem to influence the client company are extracted and categorized using the PESTEL model. In this study, the definitions of the viewpoints are described as follows.

Political factors

These refer to national or regional government policy trends, such as a change in the ruling party, a change in public agency structure, and changes in political decisions such as financial assistance and business promotion. Political decisions can impact many vital areas of business.

Economic factors

These include factors that influence the exchequer and the service price of the client company; for example, interest rates, taxation changes, and the changing prices of materials and fuel. Economic factors mainly influence customer requirements-relevant cost reduction.

Social factors

These include external factors that refer to changes in social trends, such as demographics, fluctuations in demand, and the reputation of local residents. For example, the population's aging influences major fields of business.

Technological factors

Technological factors include the development of new technology and new products by competing companies, progress in science and technology, and the aging of facilities.

Environmental factors
Environmental factors include natural environmental changes, such as weather and climate. Furthermore, global environmental issues and the depletion of natural resources are also included in this category.

Legal factors
These refer to legal environment changes that affect an organization's action. Concretely, legal restrictions, shifts in regulation standards, and trends in judicial precedent are legal factors.

STEP3. Estimation of Impact and Uncertainty
The external environmental factors that include significant impacts and uncertainty can influence the requirement structure of the client company. In this step, the driving force is selected from the environmental factors extracted in Step 2. First, the goals of the customer and the environmental factors that influence those goals are associated with relevant environmental factors. Next, environmental factors are evaluated to determine the degree of impact and uncertainty. The definitions of impact and uncertainty and the estimation procedures used for them in this study are described as follows.

Impact
In this study, the significance of a given influence in terms of customer requirements and business is defined as "impact." The impact of environmental factors is estimated in relation to other factors that influence the same customer requirements.

Uncertainty
The service designer estimates the uncertainty of the environmental factors. Uncertainty is defined as the difficulty of predicting when a given environmental factor will occur. Namely, a factor for which the service designer can easily estimate the timing is estimated to have a lower uncertainty. In contrast, if a service designer cannot estimate the timing and predict the results of the factor, it is estimated as having a great deal of uncertainty. The degree of uncertainty is evaluated absolutely.

On the basis of the definition above, environmental factors are evaluated on a five-point scale. Then, the factor that receives the highest number of points is considered the driving force.

STEP4. Scenario Construction
In Step 3, the driving force and relevant goal are identified. In Step 4, the script in the case of the occurrence of the driving force is constructed. The procedure of Step 4 is shown in Figure 3. First, on the basis of the requirement structure, the required item that is related to the goal-relevant driving force is identified (Figure 3(a)). Next, the service script that is related to the required item is identified (Figure 3(b)). Finally, the service designer constructs a new script using the driving force (Figure 3(c)). Concretely, the service designer assumes the occurrence of the driving force, and possible customer activity is also written. In this way, the service designer reconstructs the service scenario.

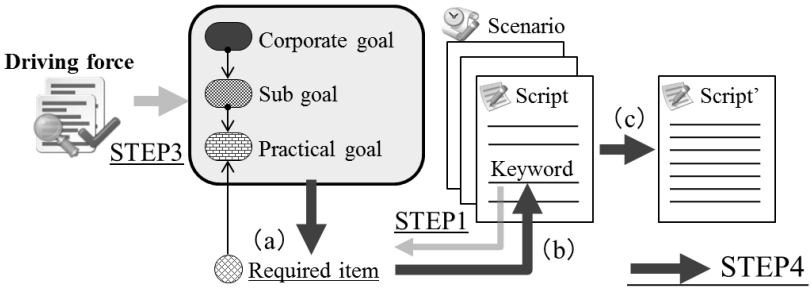

Fig. 3. Scenario restructuring process

STEP5. Identification of the Customer's Potential Requirement
Using the reconstructed service scenario, customer requirements are analyzed via the same procedure used in Step 1. Using the steps mentioned above, the service designer obtains the customer requirements while considering the driving force. Therefore, by designing a service by starting from an identified requirement, an enhanced service that can deal with a given environmental factor will be the result.

4 Application of an Example Case

This section discusses how the proposed method was applied to a B2B service, a facility construction and maintenance service, in which a utility company was the client company. In this example, the utility company offers a social infrastructure service and maintains lifelines for the public. Thus, the social responsibility of the utility company is important. On the other hand, a facility construction/maintenance company constructs and maintains the facilities of the utility company.

STEP1. Identification of Customer Requirements
First of all, a requirement structure is constructed for the as-is service. In this example, on the basis of an annual report released by the utility company which includes information about management and strategy, corporate goals were extracted (e.g., increase in profit, acceptance of social demands). Then, the corporate goals are decomposed into sub-goals; for example, the corporate goal "increase in profit" is decomposed into the sub-goals "cost reduction" and "business expansion."

Next, the practical goal, which is the objective of the stakeholders in the client company, is identified. In this example, the practical goal "cost reduction of utility work" is identified by focusing on stakeholder-relevant utility work, and this practical goal is associated with the sub-goal "cost reduction" (Figure 4 (A)).

Then, a service scenario, which is a story about a customer's activity to achieve this practical goal, is written (Figure 5). From the script written for the service scenario, the service designers identify the customer's requirements (Figure 4).

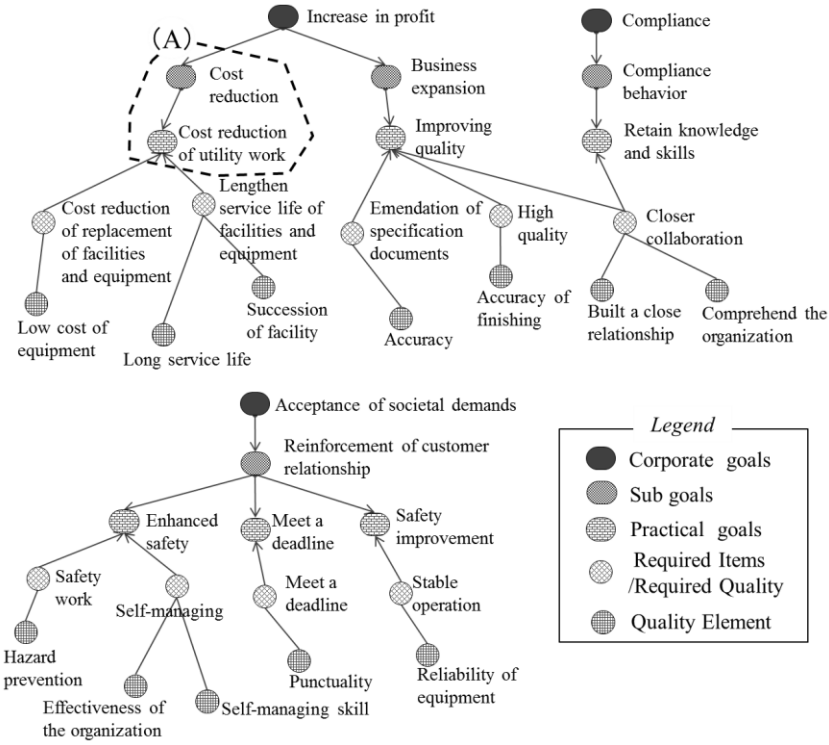

Fig. 4. Requirement structure of utility company

- Activity: Construction/Safety plan
- Practical goal:
  - Cost reduction
    - After a field explanation, we will request the estimation for the facility construction/maintenance company.
    - The necessary equipment is ordered from the manufacturer by the supplies division. We want to avoid equipment modification in terms of cost, technique, environment, and system.
    - We request the estimation of construction for the facility construction/maintenance company. We want to complete the construction work with low cost as possible.
    - We create a specification sheet. In recent years, workers familiar with facility construction, have retired. Thus, the technical capabilities is decreasing. Hence, we worry that the specification sheet will be unmatched with a real construction field. We prefer suggestions and revisions about the specs from people in the field.
    - When we make the construction plan, safety and quality are emphasized, then due dates and cost. Namely, we must not decay the safety and quality of the construction for cost reduction. Safety is the first priority.
    - ……

Fig. 5. Script template (partial)

STEP2. Extraction of Environmental Factors

In this step, the first information about the environmental factors affecting the client company was collected based on an annual report that the client company released.

In this example, 31 kinds of information were collected, such as "cutting subsidies for wind power enterprise" and "demand of applying noise regulation low for the wind power plant." Then, this information was placed into six categories of the PESTEL framework. For example, "cutting subsidies for wind power enterprise" was placed into the political factors category, and "tightening environmental regulations" was placed with the legal factors. The result of classification is shown as Table 1.

Table 1. Environmental factors about the utility company

PESTEL framework	Extracted factors
Political factors	Government policy trends relevant to global warming, Deregulation of electric utilities, Cutting subsidies for wind power enterprise
Economic factors	Lack of space for construction of new facilities, Escalating fuel price, Economic down turn, interest rate fluctuation
Social factors	Increase demand for cooling and heating, Increase in broadband subscriptions, Demand for electric rate decrease, Decline in power demand, Mass retirement of skilled workers, Shortfall in young workers, Electricity-dependent society, Demand of utility work during nighttime hours, Low demand for applying noise regulation for the wind power plant, Occurring compliance violation
Technological factors	Decrease of construction and repair work for the plant, Coming of age of large-scale electrical power utilities, Extensive replacement of facility equipment, Deteriorating technology of utility company, Increase of large construction work, Leaking of personal/company information
Environmental factors	Recent low summer temperatures and high winter temperatures, Increase of natural disasters (e.g., earthquake, torrential downpour), Weather variance
Legal factors	Obligation of concern about energy and environmental issues, Fuel cost adjustment system, Tightening environmental regulations

STEP3. Estimation of Impact and Uncertainty

Environmental factors, extracted in Step 2, are associated with goals in the requirement structure, and then evaluated to determine the degree of impact and uncertainty. In this case, when service designers focused on the sub-goal "cost reduction," the environmental factor "escalating fuel price" is associated with the sub-goal. The environmental factors relevant to the sub-goal "cost reduction" are shown as Figure 6. Next, environmental factors are evaluated to determine the degree of impact and uncertainty, and then "extensive replacement of facility equipment" is identified as a driving force (Table 2).

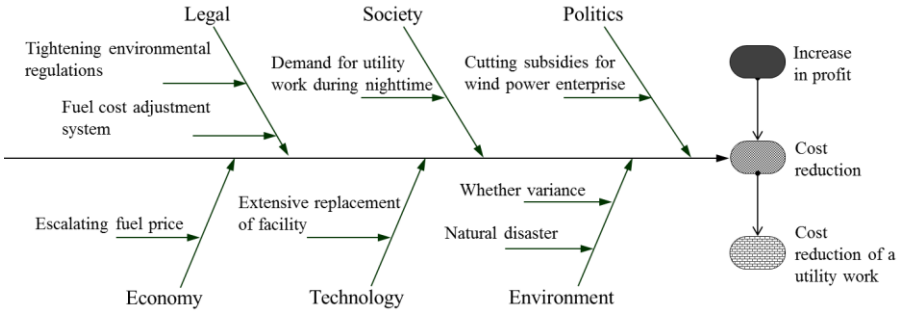

Fig. 6. Environmental factors relevant to the sub-goal "cost reduction"

Table 2. Results of impact/uncertainty estimation

Driving force	Impact	Uncertainty
Cutting subsidies for wind power enterprise	3	4
Escalating fuel price	4	3
Demand for utility work during nighttime	3	3
Extensive replacement of facility equipment	5	4
Increase of natural disasters	2	4
Weather variance	1	1
Fuel cost adjustment system	2	1
Tightening environmental regulations	4	2

STEP4. Scenario Construction

In this step, the script in the case of the occurrence of the driving force is constructed. In this case, on the basis of the requirement structure, the quality element "low cost of equipment" is identified as a relevant factor to the sub-goal "cost reduction." Then, the script that is related to the quality element is identified. Thus, the script related to the driving force is also identified. Concretely, first of all, the quality element "low cost of equipment" is identified by focusing on the keyword "low cost." Thus, the script underlined is identified as influenced by the driving force (Figure 7(a)).

Next, the scenario is reconstructed based on the driving force. In this case, the service designer assumes the occurrence of the driving force "extensive replacement of facility equipment," and possible customer activity is also written. Concretely, in the case of occurrence of the driving force, the skilled worker employed at the time of construction has already retired. Furthermore, the skills were not passed on to younger workers. For this reason, there is fear of a prolonged construction period and increased cost. The script mentioned above is incrementally written as a new script (Figure 7(b)).

- Activity: Construction/Safety plan
- Practical goal: − Cost reduction
- Driving force: − Extensive replacement of facility equipment

- After a field explanation, we will request the estimation for the facility construction/maintenance company.
- The necessary equipment is ordered from the manufacturer by the supplies division. We want to avoid equipment modification in terms of cost, technique, environment, and system.
- (a) *We request the estimation of construction for the facility construction/maintenance company. We want to complete the construction work with low cost as possible.*
- (b) *On this occasion, it is necessary to replace the equipment. However, skilled worker, who worked in the time of constructing, is already retired. Furthermore, the skills were not inherited on to younger workers. Because of this reason, there is fear that the period of construction is prolonged and the cost increases.*
- We create a specification sheet. In recent years, workers familiar with facility construction, have retired. Thus, the technical capabilities is decreasing. Hence, we worry that the specification sheet will be unmatched with a real construction field. We prefer suggestions and revisions about the specs from people in the field.
- When we make the construction plan, safety and quality are emphasized, then due dates and cost. Namely, we must not decay the safety and quality of the construction for cost reduction. Safety is the first priority.
- ……

Fig. 7. Restructured service script

STEP5. Identification of the Customer's Potential Requirement

In this step, the keyword "Inherit technique" is extracted from the restructured service script (Table 3), and then a new required item, "inherit technique," and new quality element, "Technique inheritance," are identified. Furthermore, these items are associated with the practical goal "cost reduction of utility work" (Figure 8).

Table 3. Result of RSP identification template

Keyword	Required item/ Required quality	Quality element
Inherit technique	Inherit technique	Technique inheritance

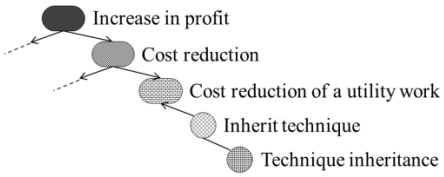

Fig. 8. Result of restructuring requirement structure (partial)

5 Discussion

In this paper, the facility construction and maintenance service is used as the example case. New requirements of the utility company were extracted. On the basis of the existing method, the requirements such as "lengthen service life of facilities and equipment" were identified to achieve "cost reduction." On the other hand, in this

paper, the driving force influencing the requirement structure of the utility company is identified, and then the requirement "inherit technique" is additionally extracted. Thus, a concrete requirement item is identified while considering the future occurrence of cost escalation. On the basis of this requirement, the service designer can take variable environmental factors into consideration in the design.

By using service scenario planning, the service designer can analyze the business environment of a client company from the place of service provider. However, it is not easy to minutely analyze environmental factors in terms of costs and volume of information. Thus, an easily applicable supporting method will be required. Concretely, supporting an association between environmental factors and goals in Step 2, and the evaluation index of impact and uncertainty in Step 3, are required.

6 Conclusion

This paper proposes a supporting method that service designers can use when building their service strategies, to help consider environmental factors and grasp customers' potential requirements. To achieve this purpose, the requirement analysis template is integrated with the scenario planning methodology, which is a method used to consider environmental factors for business strategy planning. Future work includes identifying a method for validating the identified customer's requirements, and a supporting method to help the service designer easily apply the service scenario planning.

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