Relationship between Externalized Knowledge and Evaluation in the Process of Creating Strategic Scenarios

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ABSTRACT

Social systems are changing so rapidly that it is important for humans to make decisions considering uncertainty. A scenario is information about the series of events/actions, which supports decision makers to take actions and reduce risks. We propose Action Planning for refining simple ideas into practical scenarios (strategic scenarios). Frameworks and items on Action Planning Sheets provide participants with organized constraints, to lead to creative and logical thinking for solving real issues in businesses or daily life. Communication among participants who have preset roles leads the externalization of knowledge. In this study, we set three criteria for evaluating strategic scenarios; novelty, utility, and feasibility, and examine the relationship between externalized knowledge and the evaluation values, in order to consider factors which affect the evaluations. Regarding a word contained in roles and scenarios as the smallest unit of knowledge, we calculate Relativeness between roles and scenarios. The results of our experiment suggest that the lower the relativeness of a strategic scenario, the higher the strategic scenario is evaluated in novelty. In addition, in the evaluation of utility, a scenario satisfying a covert requirement tends to be estimated higher. Moreover, we found the externalization of stakeholders may affect the realization of strategic scenarios.

TYPE OF PAPER AND KEYWORDS

Regular research paper: *externalized knowledge, strategic scenario, decision making, Action Planning, Innovators Marketplace*

1 INTRODUCTION

A scenario is information about the series of events or actions, which supports decision makers to take actions and reduce risks. A scenario is created by externalizing and connecting related knowledge in series, referring to objective information introduced by data. Humans, who are decision makers, read, interpret and make decision, and/or perform actions according to the scenarios. In this sense, a scenario might be regarded as a well-considered plan, which encourages performance and reduces risks of taking actions. Traditional methods for generating scenarios in companies or institutions are proceeded by leading a single scenario, contributing costs and time, obtaining significant parts from enormous amount of data, assembling professionals, performing discussion and evaluation. As shown in Toulmin model [1], leading a single logical conclusion from data or backing has been thought to be better.

However, a strategy or plan led by the single scenario is of high risk in the period of sudden change in social systems. Moreover, even if we spend enough time and large amount of cost for creating scenarios,

social systems may dramatically change, and the created scenarios come to be useless or ineffective. It is important for humans to create useful scenarios quickly and rationally, and make decisions based on those scenarios. It is also important not only to support decision makers to create scenarios, but also to evaluate the scenarios. This is because only to support the creation of scenarios does not mean to support the decision making sufficiently. It is necessary to support the proper assessment of scenarios.

In this paper, we propose the method, Action Planning, for creating a strategic scenario. A strategic scenario is information about logical series of events or actions to achieve a goal by considering related knowledge and information. Moreover, we set three criteria for evaluating a strategic scenario - novelty, utility, and feasibility – and compare externalized knowledge in strategic scenarios, in order to examine which knowledge affects the evaluation of the strategic scenarios. By clarifying the relationship between externalized knowledge in strategic scenarios and evaluation, the part of scenario-generating process required to support would be clear.

2 RELEVANT STUDY

In this section, we discuss the related research work on methods for creating scenarios, and criteria for evaluating scenarios.

2.1 Methods for Creating Scenarios

Decision makers discuss with highlighting pieces of knowledge related to their goal, and plan the scenarios of actions. The pieces of knowledge included in the scenario are expected to be consistent with each other, and the relationships between them are clear. In this sense, it can be said that a scenario is the logical series of knowledge.

Nishimura [2] has defined a scenario as a story in external circumstance constructed objectively in the field of business, and shown that it is necessary for companies to elaborate a strategy by considering several scenarios where significant changes are expected. Heijden [3] has applied the method of Scenario Planning to business from the viewpoint of management strategy, and characterized scenarios as the success formula of an organization. In his study, Scenario Planning has been proposed as a method for creating business ideas from scenarios, considering uncertainty in the environment and in organizations and companies. Heijden pointed out that a scenario should be evaluated in various situations in the future.

Ohsawa and McBurney [4] have defined a scenario as a sequence of events that occur in a certain context.

Considering uncertainty, a chance is regarded as the crossroad of multiple possible scenarios obtained from data. By creating a graph called a scenario map, which shows correlations among events in data using KeyGraph [5], scenarios are discussed and created as possible sequences of situations/events and actions. Ohsawa extended this to a creativity support method, Innovators Marketplace [6]. Innovators Marketplace is a gamified workshop, where participants find significant issues and solutions by combining pieces of knowledge about events/actions placed on the scenario map.

In risk management about disasters, scenarios are created by simulation systems. For example, in estimating damages of tsunami, it is desired to examine scenarios with physical simulations on models of movements of land crust, water, and also various people working in various situations and roles, rather than a single scenario, hypothesizing various situations [7].

According to these studies, the following two features could be derived:

1. The creation of scenarios is not a sheer method for predicting the future accurately, but a set of stories created for and by discussing uncertainty in the future.

2. Scenarios can be created based on objective data, human experience, and knowledge.

2.2 Criteria for Evaluating Scenarios

If multiple scenarios are allowed, it is necessary to select one scenario and take actions based on it. In order to select one plausible scenario for making decisions, it is required to evaluate and compare scenarios. In order to assess whether generated scenarios deserve to be realized or not, it is necessary to discuss how to evaluate scenarios at any evaluation criteria. In previous studies, various methods and criteria for evaluation have been proposed.

Brainstorming [8] is a method for creative problem solving, where ideas are evaluated by "quality." The quality of ideas in brainstorming means the uniqueness, which is evaluated by organizers. Takahashi [9] evaluated ideas created in methods of creation by quantifying three criteria, "fluency (the speed or the number of generated ideas)", "flexibility (the width or the variety of ideas)" and "uniqueness (the originality of ideas)". Finke et al. [10] established a model of creative activity from the aspect of cognitive process, and evaluated ideas using "originality" and "practicality." Ohsawa [6] adopted "novelty", "reality (feasibility)" and "utility" in Innovators Marketplace, and Innovators Marketplace on Data Jackets [11],

which aids human's process for creating solutions and discovering a latent value of data. Heijden [3] admitted that there is no absolute indicator for evaluating ideas and scenarios, and showed that evaluation criteria and numerical indicators are brought from various sectors of organizations or companies. As a result, ideas and scenarios tend to be assessed on experiences in business and knowledge of experts attending discussion.

Therefore, it is necessary to introduce common evaluation criteria, which quantify the values of ideas and scenarios. Moreover, quantified values and models should be easy to deal with by computers. Therefore, our future work includes ranking scenarios in response to a query of searching useful scenarios.

3 ACTION PLANNING

In this section, we first outline Action Planning, which is a method for creating a strategic scenario, and then discuss the tree phases of Action Planning in details. A strategic scenario is information about logical series of events or actions to achieve a goal by considering related knowledge. Three criteria for evaluating a strategic scenario are presented in the following section.

3.1 Outline of Action Planning

The process of actual planning to embody ideas from objective events is the practice of adding information or related knowledge into ideas individually or in a group. Leading creative problem solving by communication in the group has advantage over an individual person, because an individual person is limited in perspective and knowledge.

Simon [12] pointed that rationality of individuals is limited because of cognitive limitations. Hayashi [13] mentioned that multiple problem solvers construct different facts in observing the same physical object because of their own contexts and background knowledge, which give different perspectives to problem solvers. Although it was thought that creative work is an activity of an individual person, creating methods such as brainstorming [8] and Synectics [14] were developed as the methods for leading creativity in a group. According to the previous studies, it can be said that the acquisition of knowledge or viewpoints by communication among group member is important for creative problem solving.

Action Planning is a workshop method for creating strategic scenarios, focusing on communication and constraint [15, 16]. Frameworks and items on the sheets provide participants with constraint. Though it is usually thought that constraint suppresses creative

works, restricting the frame of thinking really encourages participants to find atypical new viewpoints [17]. It has been also shown experimentally that constraint can enhance creativity [10]. According to these studies, Action Planning is designed for formulating a discussion and leading atypical viewpoints and knowledge in creating strategic scenarios. The main goal of Action Planning is to have participants to create strategic scenarios, by (1) analyzing requirements and issues, (2) externalizing knowledge relevant to the requirements and issues, and (3) serializing the knowledge considering relations to derive the satisfaction of the requirements or the solution of the issues. Action Planning has three phases, which are discussed in subsections 3.2, 3.3, and 3.4 respectively.

Action Planning is practiced after the execution of Innovators Market Game (IMG) or Innovators Marketplace on Data Jackets (IMDJ). IMG and IMDJ are a method for facilitating innovation by combining existent data or information about products. By collecting proper data and using tools for visualization, scenario maps (game board), e.g. KeyGraph, are created. Participants may criticize, contradict, or evaluate solutions from each standpoint through the conversation in the game. By inputting ideas created in IMG or IMDJ, strategic scenarios could be generated through the three phases of Action Planning (Figure 1).

In previous studies, several types of IMG have been proposed. Role-based Innovators Market Game (Role-based IMG) is one of them. Role-based IMG is designed to reinforce the feasibility of solutions by introducing the dimension of participants' roles. That is, participants are selected from those interested in a given topic of the workshop, so that they can play the role representing as a stakeholder for each issue to be found and discussed. Here, a stakeholder means any
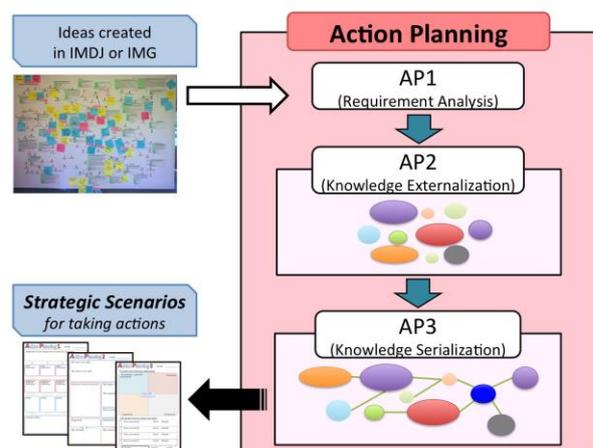

Figure 1: The Process of Action Planning

individual or organization, who may affect or be affected by the realization of any idea proposed in the workshop.

In Role-based IMG, each participant must declare his/her role at the beginning, which he/she expects to represent a stakeholder in some issues that may be found and discussed. For details of Innovators Market Game and Role-based IMG, see references [6] and [15]. Continuing to act the roles similar to IMG, participants are expected to create feasible scenarios for decision making through the process of Action Planning.

3.2 Action Planning Phase 1 (AP1): Requirement Analysis

The phase 1 (Figure 2) is designed to acquire covert requirements with discussing to detect issues that should be solved.

Based on a given theme, participants start from expressing targets' or stakeholders' requirements. These requirements are called overt requirements. Then participants discuss the latent factors of overt requirements from objective data or suppositions with logical thinking, and clarify the covert requirements and potential stakeholders relevant to solving the issues. Overt requirements can be regarded as targets' externalized requests, whereas covert requirements are targets' potential desires, which may not have been noticed even by targets themselves. Finally, participants discover the problem to be solved, and create the integrated solutions.

For example, let us assume the situation, where residents in a certain area have an overt requirement of that the local government should place more streetlights. If the government will place more streetlights on the road, it might certainly be bright at night and people's requirement would be satisfied. However, neighboring residents might complain of the streetlight being too bright at night. In addition, the power consumption may become a new social problem. In this example, in responding to overt requirements, it would be possible to cause new problems.

In order to avoid such a side effect, it is recommended in AP1 to clarify covert requirements, by considering the background factors of overt requirements. By putting a covert requirement in place of the overt requirement, one may be enabled to propose an alternative solution in order to satisfy the covert requirement. In the example of streetlights, there is a factor that dark roads are dangerous as the background of the overt requirement. Then, the crime prevention on dark roads would be considered as the covert requirement, and a solution to strengthen the patrol on dark roads may be led.

Figure 2: Action Planning Sheet 1 (AP1)

3.3 Action Planning Phase 2 (AP2): Knowledge Externalization

Phase 2 (Figure 3) is designed to externalize related knowledge for creating solutions from the requirements or solutions that were clarified in AP1. Externalized knowledge includes cost and time to realize solutions, resources (technologies, materials, money), stakeholders (targets, supporters, competitors, experts), and shared advantages or countermeasure. By filling in the items in the sheet of AP2, participants can identify the prerequisite conditions or derive constraints relevant to achieving their goals.

Let us consider an example of AP2, a solution of crime prevention on dark roads. An expert, from a security company, is involved in this solution. A neighborhood community is considered as a supporter. They share information with each other from the view point of crime prevention in the town. On the other hands, police would come to be a competitor in this solution.

Because police takes side with government, and a security company is on the side of private sector, there is a possibility that conflicts of interest in the business of crime prevention, and patrol would occur between

Figure 3: Action Planning Sheet 2 (AP2)

police and a security company. If such a situation is assumed beforehand, it is possible to identify the roles. By considering the elements associated or related with actions (decision making), it is possible to plan countermeasures in advance against the assumed problems, which may occur during execution. Similarly, it is also possible to consider the validity of the time and budget.

3.4 Action Planning Phase 3 (AP3): Knowledge Serialization

Phase 3 (Figure 4) is aimed to create strategic scenarios by serializing knowledge that has been externalized in AP2. Serialization means to find relationships among pieces of knowledge, and connect them to form a scenario (or multiple scenarios if necessary), following a particular ruleset. There are four rules for serialization to complete AP3:

1. Stakeholder management: visualizing relations among stakeholders and relevant resources.

2. Time management: dividing a project, the agenda for executing a scenario, into four stages with time series, and clarifying related stakeholders,

Figure 4: Action Planning Sheet 3 (AP3)

resources, terms, and expenditures in each stage.

3. Task arrangement: arranging tasks, roles and responsibilities with stakeholders.

4. Business modeling: Estimating the profitability of the product of the project in the market.

By connecting each element in time series, visualizing relations of stakeholders, arranging tasks with team members, and allocating the budget, participants can notice to non-coherency or conflict of pieces of knowledge and unseen essential elements. In the visualization of stakeholder management, it is necessary to describe carefully the relationship among elements (pieces of knowledge) associated with the solution, in order to reduce the conflicts in businesses.

During the process of describing the relationship among elements externalized in AP2, participants notice the part which has a leap in logic, and it is possible for decision makers to obtain or externalize new elements to resolve the conflicts. For example, if the collision between the security company and police could be solved by the intervention from the government, the government is externalized as a new stakeholder. As well as the stakeholder management, by considering the relationship among elements externalized in AP2 based on these rules, it is possible to promote to externalize new knowledge to solve the conflict.

4 EVALUATION CRITERIA IN ACTION PLANNING

In the study of Action Planning, we adopted "novelty" "utility" and "feasibility" as the scenario evaluation criteria, which are used in Innovators Marketplace. In the criterion of novelty, we introduce "relativeness" for quantifying novelty of a strategic scenario rather than of its elements. In the criteria of utility and feasibility, we compared externalized elements in strategic scenarios.

4.1 Novelty

Subjective evaluation of an idea is considered as lacking in reproducibility. In this point, it is practical to assess the value of scenarios by not only subjective evaluation of human, but also an objective method of evaluation by computers. Because novelty is the newness of scenarios to roles, it can be evaluated with less subjectivity than utility or feasibility. The newness of a scenario obtained is considered as its closeness to certain knowledge existing in an individual or in an organization. By measuring this closeness, it is expected to be possible to introduce an objective criterion to assess the novelty of strategic scenarios.

We adopt the objective evaluation method of the closeness of knowledge, Relativeness [16][18], for evaluating the novelty of strategic scenarios. A role is an attribute of an individual who belongs to an organization, and has expert knowledge to solve problems that may come out in the workshop. In other words, a role is a participant's fixed attribute as a stakeholder, and can be represented by his/her expertise prepared for performing discussion in the workshop. Relativeness is defined as the degree of how special certain knowledge is for a role. Regarding a word contained in the knowledge linked to roles as the smallest unit of knowledge, a word's closeness in certain role has following four features:

- Relativeness increases monotonically, with the increase of the word frequency in a role.

- Relativeness decreases monotonically, with the increase of the word frequency in other roles.

- Relativeness decreases monotonically, with the increase of the total number of words included in the role.

- Relativeness increases monotonically, with the increase of the total number of words except ones included in the role.

By quantifying above four features, it is possible to build the mathematical equation (Eq. (1)) to calculate Relativeness. The meaning of symbols in Eq. (1) is showed on table 1.

$$Rel(R_i, w_j) = \ln \frac{n(\overline{R_i}) \,/\, f(\overline{R_i}, w_j)}{n(R_i) \,/\, f(R_i, w_j)} \quad (i, j \in N) \quad (1)$$

Table 1: Meaning of symbols in Eq. (1)

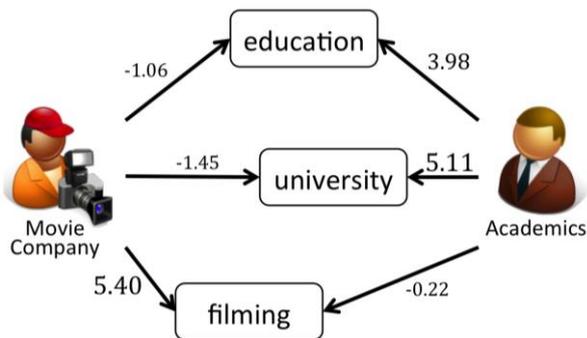|	
$Rel(R_i, w_j)$	The closeness between a role (R_i) and a word (w_j)
R_i	A certain role (a set of words)
w_j	A certain word
$n(R_i)$	The total number of words included in a role (R_i)
$n(\overline{R_i})$	The total number of words except for words included in a role (R_i)
$f(R_i, w_j)$	The word (w_j) frequency in a role (R_i)
$f(\overline{R_i}, w_j)$	The word (w_j) frequency in other roles ($\overline{R_i}$)

Figure 5: The example of Relativeness between roles and words

We calculate Relativeness by following steps.

1) We selected 16 roles (academics, government, energy company, airline company, sports official, elder, police officer, farmer, service company, rescue officer, medical officer, movie company, journalist, traffic authority, citizen, and nuclear engineer). Information of roles was obtained from Wikipedia (free online encyclopedia, www.encyclopedia.com) in Japanese, because Wikipedia has rich information about each role, including not only the outline of each role but also the history and related roles.

2) By Morphological Analysis, we extracted words and counted the frequencies of each word. We also extracted nouns as features of each role and of each piece of knowledge. The amount of extracted feature nouns is 5,447 (approximately 340 nouns included in each role on average).

3) We calculated Relativeness of a role (a set of words) to each word in the role using Eq. (1).

One example of Relativeness between roles and words is shown in Figure 5. In a similar way, by calculating Relativeness of words included in strategic scenarios, the degree of closeness between a role of the participant and a strategic scenario can be calculated. In our previous study about Role-Based IMG, the ideas, created by combining the pieces of knowledge less familiar to their roles, are tended to be evaluated with higher novelty [18].

4.2 Utility

Utility is the degree of usefulness of a strategic scenario. It is relatively difficult to model the utility of strategic scenarios because utility is an indicator, which depends on the context of each scenario. Therefore, it is difficult in extracting the common factors of usefulness from each scenario. However, each strategic scenario has a target to provide services or products. In our study, we regard utility as the indicator of how useful for targets or consumers a strategic scenario is. We hypothesize that a scenario, which can be taken more confidently as a solution for covert requirements in AP1 (Requirement Analysis), is evaluated with higher utility. We compare which one of overt requirements and covert requirements each scenario satisfies in the highly evaluated group and in the lowly evaluated group.

4.3 Feasibility

Feasibility is the indicator of possibility to realize a scenario. Rather than the sheer amount of knowledge included in a strategic scenario, it is important whether the stakeholders and resources in realizing solutions are considered sufficiently. We regard resources and stakeholders as knowledge elements that support the feasibility of strategic scenarios, and compare externalized resources and stakeholders on AP2 and AP3.

5 EXPERIMENTAL DETAILS

This section presents the purpose of our experimental study and the experimental steps. The experimental results are described and discussed in the next section.

5.1 Purpose

The purpose of this experiment is to examine which externalized knowledge affects the evaluation criteria of the strategic scenarios generated by Action Planning.

In the evaluation criterion of novelty, we examine the relationship of subjective evaluation by participants and objective evaluation by Relativeness. We validate the plausibility of Relativeness as the method for estimating objectively the novelty of strategic scenarios. In the criterion of utility, we compare which requirement (overt or covert) each scenario satisfies. In the criterion of feasibility, we compare the amount of externalized elements in AP2 and AP3.

5.2 Experiment Steps

27 university students participate in our experiments, and they did not have knowledge about Role-based Innovators Market Game or about Action Planning before the experiments. We divide these 27 participants (subjects) into two groups: G1 with 13 subjects, and G2 with 14 subjects. We set the main theme which works as a common constraint to all subjects, "creating products or services which lead a better society." To

reduce the effect of specialty of subjects or uneven distribution of knowledge, we introduced the random assignment of roles to subjects. 16 roles (academics, government, energy company, airline company, sports official, elder, police officer, farmer, service company, rescue officer, medical officer, movie company, journalist, traffic authority, citizen, and nuclear engineer) were selected based on the theme, and each subject took part in one role.

The experiment was carried out under the following steps.

1. Practicing Role-based Innovators Market Game for creating ideas (about 2 hours).

2. Practicing Action Planning for creating strategic scenarios from the ideas created in Role-based Innovators Market Game (about 2 hours).

3. Evaluating the quality of strategic scenarios subjectively according to the three criteria: novelty, utility and feasibility. Each criterion is estimated on a scale of 1 to 5 (1: bad; 2: poor; 3: fair: 4: good; 5: excellent).

4. According to Step 1, we calculate Relativeness of strategic scenarios as an objective measure of novelty, and compare its value with the values of subjective evaluation of novelty.

5. Comparing the requirement each scenario satisfies, between highly evaluated group and low evaluated group of utility in Step 3.

6. Counting and comparing the numbers of externalized resources and stakeholders on AP2 and AP3, between highly evaluated group and low evaluated group of feasibility.

6 RESULT

In this section, we show the experimental results of evaluating the strategic scenarios generated by Action Planning in terms of the three criteria: novelty, utility, and feasibility. We also examine the relationship between externalized knowledge and the evaluation values.

6.1 Novelty

Figure 6 and 7 show the diagram of Relativeness and subjective evaluations of novelty of each group (G1 and G2). The experimental data show that there is a negative correlation between Relativeness and the evaluation value of novelty: G1: $r = -0.61, p < 0.05$; G2: $r = -0.50, p < 0.05$, where r is a correlation coefficient, and p a value of probability. As mentioned above, regarding novelty as newness of combination of pieces of knowledge, this result may show that
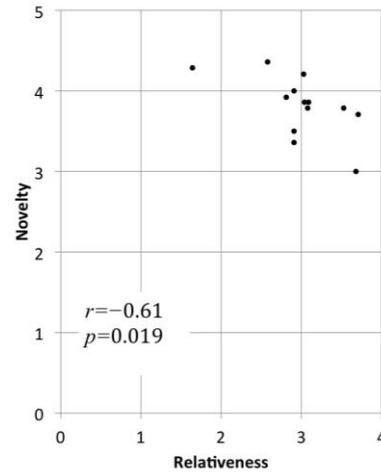

Figure 6: The relationship between novelty and Relativeness in G1
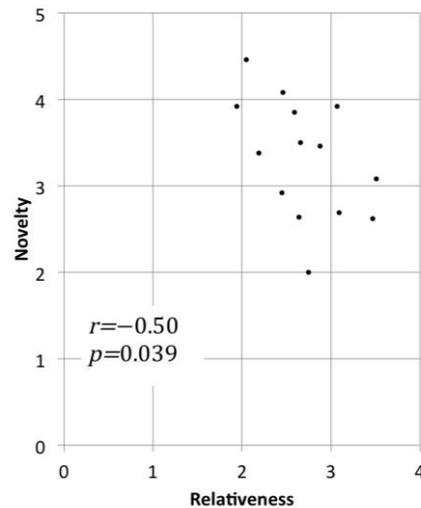(*r*: a correlation coefficient; *p*: a value of probability)

Figure 7: The relationship between novelty and Relativeness in G2
(*r*: a correlation coefficient; *p*: a value of probability)

combining low relative information with roles may increase the novelty of strategic scenarios.

6.2 Utility

Utility is the degree of targets' benefit. According to the average of the experimental value of utility obtained from Step 1 of Section 5.2, we divided each group (G1 and G2) into highly evaluated group and lowly evaluated group. The subjects, whose evaluation value is above the average value, belongs to the highly evaluated group; the subjects, who gave a value lower than the average one, is in the low evaluated group. Table 2 gives the number of subjects in each group.

Table 2: Number of subjects in each group

		In G1 (13 subjects)	In G2 (14 subjects)
Criterion of utility	Highly evaluated group	7 subjects	8 subjects
	Low evaluated group	6 subjects	6 subjects
Criterion of feasibility	Highly evaluated group	7 subjects	8 subjects
	Low evaluated group	6 subjects	6 subjects

We compared the ratio of satisfied requirements in AP1. Figure 8 and 9 show the tendency that the strategic scenarios, which propose solutions to targets' covert requirements, got high marks in utility.

6.3 Feasibility

In the evaluation of feasibility, we divided each group (G1 and G2) into highly evaluated group and low evaluated group according to the value of feasibility obtained in the experiment as in the evaluation of utility. The highly evaluated group gives values higher than the average, and the evaluation values from the low evaluated group are lower than the average. The number of subjects in these groups are listed in Table 2.

We regard resources and stakeholders as knowledge elements that support the feasibility of strategic scenarios. An element means a word included in the strategic scenario. Stakeholders mean customers, specialists, competitors, and supporters. Resources mean technologies, terms and budget. We compare the number of externalized elements (stakeholders and resources) in AP2 and AP3 according to Eq. (2) and Eq. (3).

$$num(ST) = \sum stakeholder_i \quad (i \in N) \qquad (2)$$

$$num(RE) = \sum resource_j \qquad (j \in N) \qquad (3)$$

We compared the externalized stakeholders of AP2 and AP3. Although we cannot find the significant difference in comparison of numbers of externalized
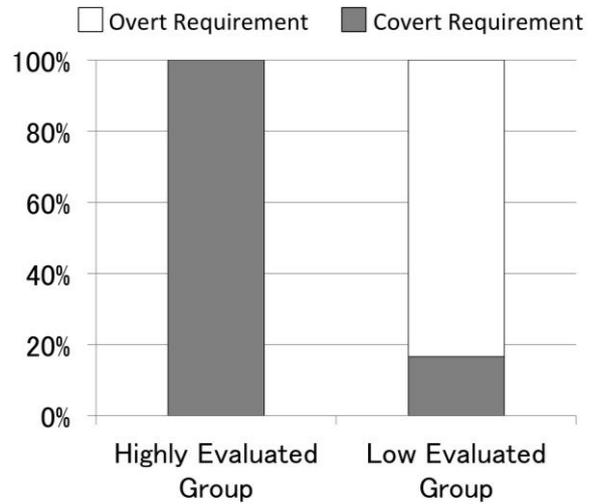

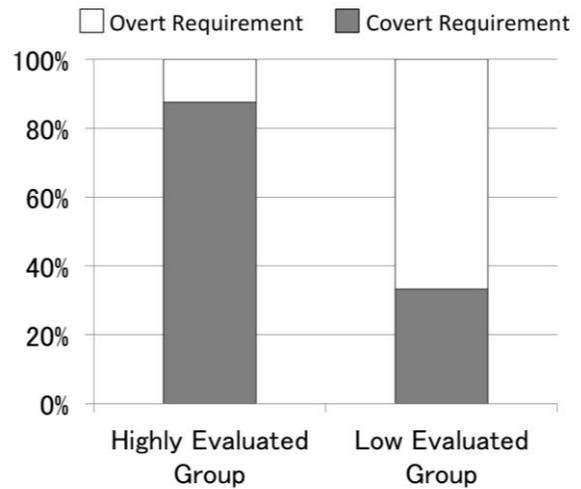**Figure 8: The ratio of satisfied requirements in G1**

Figure 9: The ratio of satisfied requirements in G2

stakeholders in AP2, there is a difference in externalized stakeholders in AP3 in G1 and G2 (Table 3 and Table 4). This result implies that, in the process of creating strategic scenarios, externalization of new stakeholders in serialization (AP3) affects the feasibility of strategic scenarios more than the externalization of stakeholders (AP2).

On the other hand, comparing the sum of the numbers of externalized resources in AP2 and AP3 between highly evaluated group and low evaluated group, we cannot find significant difference (Table 5 and Table 6).

Table 3: The comparison of externalized stakeholders in AP2 and AP3, in G1

G1	Feasibility (SD)	$num(ST)$ in AP2 (SD)	$num(ST)$ in AP3 (SD)
Highly Evaluated Group	3.75 (0.20)	7.57 (2.19)	3.43 (2.19)
Low Evaluated Group	2.80 (0.20)	4.33 (2.69)	9.00 (2.71)
p-value	**	*n.s.*	**

n.s.: non significance, *: *p*<.05, **: *p*<.01
SD: Standard Deviation

Table 4: The comparison of externalized stakeholders in AP2 and AP3, in G2

G2	Feasibility (SD)	$num(ST)$ in AP2 (SD)	$num(ST)$ in AP3 (SD)
Highly Evaluated Group	3.62 (0.21)	7.75 (2.28)	2.75 (1.20)
Low Evaluated Group	2.88 (0.27)	7.00 (2.71)	5.00 (1.91)
p-value	**	*n.s.*	**

n.s.: non significance, *: *p*<.05, **: *p*<.01
SD: Standard Deviation

Table 5: The comparison of externalized resources in AP2 and AP3, in G1

G1	Feasibility (SD)	$num(RE)$ in AP2 (SD)	$num(RE)$ in AP3 (SD)
Highly Evaluated Group	3.75 (0.20)	2.14 (2.17)	0.86 (1.00)
Low Evaluated Group	2.80 (0.20)	2.00 (1.41)	0.67 (1.11)
p-value	**	*n.s.*	*n.s.*

n.s.: non significance, *: *p*<.05, **: *p*<.01
SD: Standard Deviation

Table 6: The comparison of externalized resources in AP 2 and AP3, in G2

G2	Feasibility (SD)	$num(RE)$ in AP2 (SD)	$num(RE)$ in AP3 (SD)
Highly Evaluated Group	3.62 (0.22)	4.00 (2.06)	1.00 (0.87)
Low Evaluated Group	2.88 (0.27)	2.67 (2.13)	0.67 (0.75)
p-value	**	*n.s.*	*n.s.*

n.s.: non significance, *: *p*<.05, **: *p*<.01
SD: Standard Deviation

7 CONCLUSION

In this paper, we suggested the method for creating strategic scenarios, Action Planning, which is designed for supporting decision making by considering uncertainty and cognitive limitations of humans. In the experiment study, roles are selected based on the theme "creating products or services which lead a better society", and each subject took part in one role. When dealing with the social issues, subjects may not be able to solve them by only existing technologies or knowledge. In this point, it can be said that this experiment has been set as a process of creative problem solving.

By introducing Relativeness, the degree of how special a certain word is relative to a role, we found a negative correlation between Relativeness and the subjective evaluation value of novelty of the strategic scenarios. In other words, strategic scenarios, which consists of low relative words of a role, get high marks in novelty. Relativeness may work as an objective evaluating method.

In the evaluation of utility, we found the tendency that strategic scenarios satisfying covert requirements are evaluated with high utility. It can be said that consumers' or stakeholders' overt requirements are so ambiguous that overt requirements hardly lead to useful solutions. In other words, the strategic scenarios, which satisfy covert requirements, may be useful solutions for consumers. In our experiment, the result suggests that examining covert requirements fosters practical problem solving.

It is suggested that the feasibility of a scenario may not increase the amount of knowledge included in scenarios. It is possible that an externalization of stakeholders in serializing elements can be a factor, which decreases the feasibility of scenarios. Namely, externalizing of stakeholders may restrict the realization of strategic scenarios. It is difficult for humans to externalizing all the relative stakeholders in advance because of the cognitive limitations of individuals. The externalized stakeholders in the process of serialization may increase the possibility of conflicts between stakeholders. Therefore, when the stakeholders are externalized in the phase of serialization (AP3), it may be important to return to the phase of requirements acquisitions (AP1) or externalization of elements (AP2).

ACKNOWLEDGEMENTS

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