Application of Technology Intelligence from the viewpoint of service value creation

Strategic planning of financial information system using TI

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Abstract— **Savioz defines Technology Intelligence (TI) as "those activities which support decision-making of technological and general management concerns by taking advantage of a timely preparation of relevant information on technological facts and trends of the organization's environment by means of collection, analysis and dissemination." Traditional TI consists of four processes: Identification of information needs, Collection of information, Analysis of the information and Dissemination of the information. This process corresponds to Goods Dominant logic (G-D logic), where TI information is delivered to customers as a product. A TI activity can be considered as a kind of service that offers relevant information via TI systems to decision makers. Therefore, the application of several concepts related to service science such as Service Dominant logic (S-D logic) for TI is proposed here in order to enhance the service quality of TI. The concept of value-in-context or context-aware service can be applied to enhance the service value of TI for decision makers. In the new TI proposed here, the collaboration between TI providers and decision makers can create service value, which is similar to the concept of "value-in-use" in S-D logic. The effectiveness of the proposed concept is demonstrated through an example that involves planning the business strategy of financial information system developers. In this example, an analysis of value-in-context is performed through interviews with top managers and project managers.**

Keywords-technology intelligence; service dominant logic; financial information system

I. INTRODUCTION

Companies need to continue offering value to customers over the long term so that they remain strong against competitors. To do this, companies regularly collect information on the competition, and they need to strategically plan the information collection process. To develop a strategy that is necessary for product and technology development, application of the Technology Intelligence (TI) concept is a particularly effective method.

Lichtenthaler [2] focused on the opportunities and threats in a company's decision making, and defined TI this way: "The goal of technology intelligence is to exploit potential opportunities and to defend against potential threats, through prompt delivery of relevant information about technological trends in the environment of the company. Technology intelligence encompasses the activities related to the collection, analysis and communication of relevant information on technological trends to support technological and more general decisions of the company." Savioz [1] defines TI as "those activities which support decision-making of technological and general management concerns by taking advantage of a timely preparation of relevant information on technological facts and trends of the organization's environment by means of collection, analysis and dissemination." In addition, Kerr [3] defined TI; some differences, though, are found among the various definitions. However, the concept of TI as an activity that supports decision making in technical issues or management is a common element in the definitions.

Studies on TI have so far been conducted from the viewpoint that TI providers produce › TI reportfi and offer it to TI consumers who demanded TI. In other words, people think of TI from the viewpoint of Goods-Dominant logic (G-D logic). However, decision making is an action that is done by using both knowledge that the decision maker had and a TI report offered as a result of the TI activity by TI provider. Therefore, the decision making can be regarded as being a co-creation process of value between a TI provider and a TI consumer (the decision maker). In other words, TI is a service provided by the TI provider to the decision maker. This way of thinking is similar to Service-Dominant logic (S-D logic) in which a value of the service is co-created for value in context or value in use [4]. Therefore, we should think of TI as the co-creation of service value to enhance the value of the provided TI.

In this study, we have considered a TI system from the viewpoint of service value co-creation between decision makers and TI providers, and we propose a new decision making process model using TI. To demonstrate the effectiveness of the proposed process model, we investigate a finance information system development business as an example.

II. TRADITIONAL TI

A TI process from the viewpoint of industries was studied by Porter [5] and Lichtenthaler [6]. Tschirky [7] explains that the TI process consists of four sub-processes: identify information needs, collect information, analyze information,

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and disseminate information (Fig. 1). First, in the process of determining information needs, we limit the range of information by the decision maker and also make the requirement clear. Second, based on the requirement that were specified in identification of information process, we collect the necessary information. Third, in the analysis process, we estimate the importance of the gleaned information. Finally, the TI process is completed by disseminating the results of the TI activity to the decision maker, who is also the TI consumer.

Figure 1. Traditional process model of TI

Kerr [3] subdivided these processes further and came up with a concept model as an iteration of six processes: coordinate, search, filter, analyze, document, and disseminate. Furthermore, this model clearly described the processes of identifying requirements and of decision making (That is described as "decide"). This concept is similar to Lichtenthaler's idea. The major characteristic of this concept is the addition to the TI process of feedback given by decision makers on gaps they have recognized in technical needs and information. Moreover, although this concept is more characteristic at the process of "decide" has been added than Fig. 1. This concept indicates that intelligence is provided to decision makers, and decisions are made based on the provided intelligence. Savioz [1] expresses the process of TI using the following five processes: formulation of information needs, information collection, information analysis, information dissemination, and information application. Furthermore, he mentions that "The TI process consists of different stages in the value creation process of intelligence" and "The process of TI is the process of value creation."

The process of conventional TI is explained as a form of push reporting to offer information to the decision maker and is a similar idea to G-D logic[8], which offers a product to the consumer.(Fig. 2) However, in terms of TI activity, the decision maker carries out decision making based on TI with their knowledge, and the value of TI is created at the moment. In other words, the effectiveness of the TI activity cannot be evaluated using only the provided information itself. We must evaluate the TI value by the results of co-creation with the decision maker and TI provider based on the output of TI activity. This corresponds to the "value in use" concept in S-D logic. We must consider how to improve TI value based on this characteristic in decision making. The above discussion indicates the importance of creating a new TI process model which is derived from the viewpoint of service value co-creation. However, there are no studies to date that mention a TI process model from the viewpoint of service.

Figure 2. Push type reporting of TI

III. PROPOSAL OF NEW PROCESS FOR TI

A. G-D logic and S-D logic in TI

Kichen [9] compares G-D logic and S-D logic from the viewpoint of purpose, exchange unit, resource used, value chain, and the role of the customer. Table 1 presents the characteristics of the TI process based on these ideas.

TABLE I. TI FROM THE VIEWPOINT OF G-D LOGIC AND S-D LOGIC

	G-D logic		S-D logic	
Purpose	Producing, Selling	Product of TI	Value co-creation	Value creation by decision making
Exchange Unit	Goods and services, output	Document of TI	Service and experience	Decision making based on TI
Customer role	Purchaser or consumer	Consumer of TI	Co-producer	Co-producer of decision making

In the traditional TI process, as a result of TI activities such as information collection and analysis, the outcome of the process is produced as a document. The principal objective was in disseminating the document to the consumer of the TI. In other words, we understand that the traditional TI process is based on G-D logic, as shown in Table 1. In contrast, we consider TI from the viewpoint of S-D logic. The purpose of TI is to support decision making. Decision making is said to be a value co-creation achieved by combining the output of TI and the knowledge of the consumer of TI. In this collaboration, the experience of decision making based on TI or a decision making support service based on TI can be the exchange unit. Finally, the role of the decision maker is said to be that of a co-producer carrying out good decision making jointly with TI provider in the TI process. We can thus enhance the TI process by applying S-D logic.

B. Concept of TI model from the viewpoint of services

In this chapter, we explain the basic premise of the new TI model based on a service viewpoint. First, we consider the value created by TI. The purpose of TI is to support decision making. This decision making is performed by the decision maker. The decision maker makes decisions by combining his own knowledge with the output of the TI activity. Value is created through this co-creation achieved with TI output and decision maker knowledge for the first time. The decision making result is assumed to be different depending on the situation, which relates to the timing of decision making, the decision makers' knowledge and other such factors, even if the same output of the TI process is provided to decision-makers. In other words, the value in decision making is value-in-context because it depends on the context at that time. Based on the above considerations, the value of TI in decision making has the characteristics of value-in-context.

If we consider co-creation for decision making, the concept of "Ba" is important. "Ba" refers to the situation in decision

making in which knowledge of the decision-maker and information provided in the TI process are integrated to achieve effective decision making. (Fig. 3) This "Ba" (Field) is considered as a physical or virtual field that the decision maker and TI provider share. The "Ba" situation at the moment of decision making influences the effectiveness of the value of the information provided by TI, so both the TI provider and the decision maker should understand "Ba" to be a decision making situation or context. "Ba" consists of various factors such as the business situation, problems to be solved, and the requirements of the decision maker.

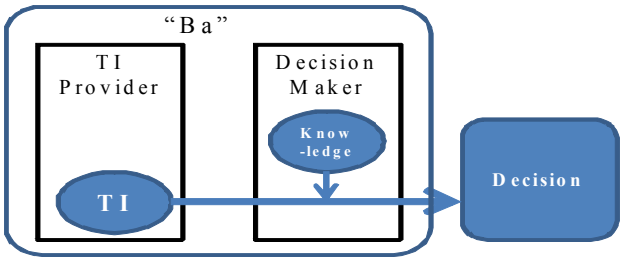

Figure 3. Integration of knowledge and "Ba"

Next, let us consider what the TI provider should do to enhance the value of TI. The TI value is determined in decision making; that is, it is value in use. Therefore, for the TI activity, it is necessary to determine what kind of information decision makers want to know. In other words, we understand that a phase of understanding is necessary where TI providers understand the context concerning the decision maker. With that in mind, our new TI process has two phases, as shown in Fig. 4. The first is the "understanding information needs phase" in which an information provider supposes the information needs and proposed it to decision maker. The second is a "decision making phase" in which decision making is supported based on the information needs. The "decision making phase" is a part of the conventional TI process shown in Fig. 1.

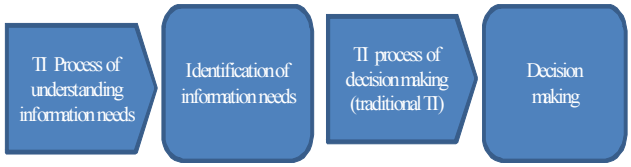

Figure 4. Two phases of TI based on S-D logic

The phase to clearly understand information needs is required from the viewpoint of service in order to give higher TI value. This is the phase in which the context is understood in decision making.

C. *TI process model from the viewpoint of service*

In the new TI process, the following elements are very important from the service viewpoint.

a) Integration of knowledge by decision maker and information provider

b) The phase of understanding the context of the decision maker and the information needs

In addition, a feedback loop is required in order to review output obtained by integrating the knowledge of decision maker and information of the TI provider. It leads to improving value of TI to review the output. "Ba" is also an important concept for integrating the knowledge in order to create effective TI.

We propose a new process model of TI based on a service viewpoint, as shown in Fig. 5. This process involves co-creation of the service value in the TI process. In addition, we call a process that leads directly to conventional decision making a "decision making phase," which is shown in the right side of Fig. 4, because this phase consists of a series of processes which start after information needs have been identified. This phase includes information collection, analysis, and dissemination. In contrast, we call the process of determining information needs by the decision maker and information provider the "understanding information needs phase," which is shown in the left side of Fig. 5. This is because it is a phase of identifying the information needs of decision makers.

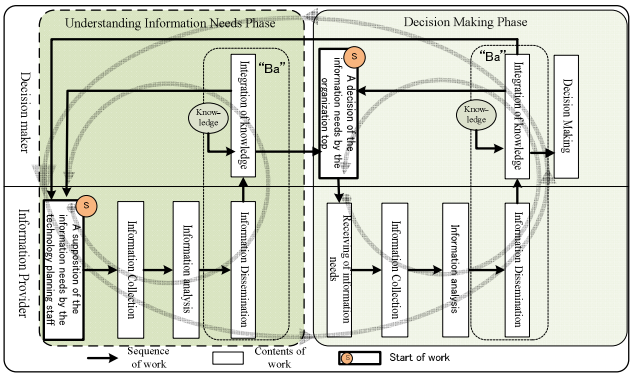

Figure 5. TI process model from service viewpoint

IV. EXAMPLE OF TI IN FINANCIAL INFORMATION SYSTEM DEVELOPMENT BUSINESS

A. *Present conditions analysis and a problem*

The target of this example analysis is a business, referred to as organization "A," which develops financial information systems. Organization A does not explicitly conduct TI activities as a regular strategy or part of its mission. TI functions are assigned in an ad hoc way to individuals when it is necessary. The purpose of this analysis was to come up with an effective TI process for organization A.

We interviewed top managers and project managers in organization A to clarify the following purposes:

Purpose 1: How are activities that are equivalent to TI, such as acquisition and analysis of technical information, performed?

Purpose 2: Is an investigation of technical trends related to TI necessary or not?

The main questions in the interview were as follows.

1) Have you investigated information on technology, such as technical trends, before?

2) （If answer 1） is "YES"）What was the purpose of investigating the technical information?

3) （If answer 1） is "YES"）What method did you use to investigate the technical information?

As a result of these interviews, we were able to understand the necessity for activities equivalent to TI, or to understand the technical trends, from the answers. The timing of conducting TI activities was common, and these were development time of the plan in the year or development time of the Middle-range plan and so on.

On the other hand, one interviewee remarked, "Actually, I couldn't have examined such trends a lot, but not enough to be able to devise a strategy and a policy or plan," even during the period of drafting a strategic plan. From this remark, we understood that the introduction of TI activities to organization A is not ready to be carried out while decision makers recognize the necessity for it.

Past study on the TI process, the identification of the information needs of the decision maker (or the determination of the information needs that are in the target range of TI activities between the decision maker and the informant） becomes the starting point in the TI process. Then, after starting the TI process, a TI provider will carry out the information collection or analysis based on the information needs. In organization A, while top managers recognize the necessity at the time of the organization's technical strategic development, top managers and technology planning staff are not able to be settled in information needs of the TI activity. This is because top managers as decision makers and the technology planning staff as a TI provider do not always identify what kind of information is important for decision making. In other words, the challenge of conducting TI activities was not carried out because of a lack of collaboration between decision makers and technology planning staff. A problem exists in a structure that a TI provider receives a decision on the information needs from the decision maker for starting TI process, which reflects the past decision making style, such as G-D logic.

B. Seeking a solution

To solve this problem, the technology planning staff, which consists of the information providers (TI providers), starts to lead the process of deciding information needs as part of the normal business routine. In other words, it is the form that the information providers provide TI to the consumers. The technology planning staff estimates the information which seems to be effective for their technology strategy decision making and reports it regularly to top managers. The technology planning staff must understand the needs of top managers as decision makers, and therefore they confirm the intentions of the top managers and revise them through discussions in "Ba" using the periodic report.

In this example, information (TI) from the technology planning staff is utilized in the periodic meetings held by top managers, and the technical aspects are discussed (once a month). After information on technical trends is explained by the technology planning staff in this meeting, they answer some questions and evaluations of the provided information. The technology planning staff can therefore understand the intents of the top managers through these evaluations and discussions and can finally identify the requirements of the top managers.

We interviewed the person in charge of technical issues in the organization to confirm the effectiveness of TI in this example. From the interviews in which questions were asked about the reporting by the technical planning staff in the monthly meetings, some of the affirmative opinions were obtained; "It is better to have a little more time and add more explanations" and "It was not push type reporting, but it would be better to continue (with this activity). I want to know the information like technology trends". Another opinion was, "Because the acquisition of such information cannot be considered during busy periods of current projects, I want to establish an acquisition route for getting such information." From the above discussion, we were able to confirm the effectiveness of the "understanding information needs phase." In this phase, technology planning staff provides TI to top managers as a service. They communicate at the "Ba". In the interviews asking about the necessity to investigate technical trends in the financial information system development business, one person remarked, "I would examine a trend sufficiently in the future, but not enough to be able to establish a strategy and a policy/plan". We understood this problem was solved.

C. Evaluation of the solution

In this case, a technology planning staff member, who was an information provider, carried out the TI activity. As the front stage of a traditional TI process model to perform conventional decision making, the technology planning staff member estimates the information needs of the decision makers and disseminates the outcome of the TI process based on them. This is effective for the decision makers. In particular, as the "Ba" of the value co-creation between the decision maker and the technology planning staff member, a liaison meeting was held in this example. In addition, the technology planning staff member obtained comments from the top managers and this gave them a deeper understanding of context in the top managers' decision making. We also confirmed that the feedback loop for reviewing the TI process was effective.

The process flow of this example is shown in Fig. 6. In the first phase, the assumed Context in the decision making of top managers, which is a demand of the decision maker, is confirmed by the technology planning staff in "Ba," which is called the liaison conference. In the second phase, information is collected and analyzed based on the needs of the decision maker, and output as the TI activity. Then, a "Ba" is held, where the output of the TI activity is shared with the decision maker, and the decision maker can review the output of the TI activity or carry out further decision making when the technology planning staff (information provider) reports it to the decision makers (top managers or project managers) in the organization.

- We found the following things from the above. The TI process starting from TI provider is effective.
- "Ba" is important for TI providers to share the situation and get feedback from consumers.
- TI provider provides a TI service to consumer same as an S-D logic.
- "Ba" is important to identify the needs or make decision as a co-creation process of TI.

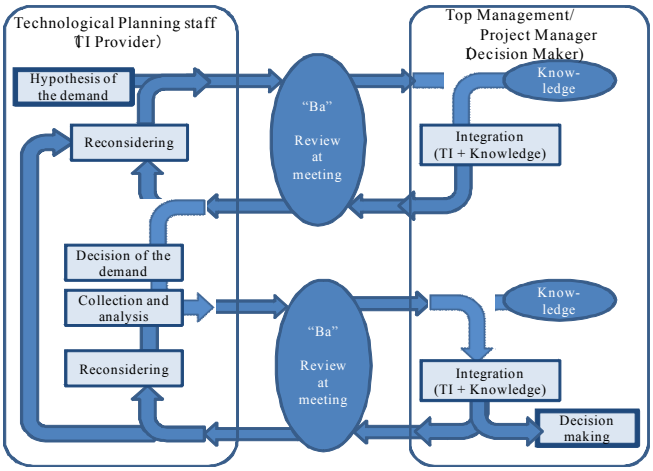

Figure 6. Example of TI process used to develop financial information system

V. CONCLUSION

In this study, we showed a new process model of TI to improve value-in-context from the viewpoint of service. It is important to think about a new process model of TI in which the viewpoint of service value co-creation is applied in order to improve TI value. However, no previous studies have investigated a TI process model from this viewpoint. The proposed model includes an "information needs decision phase" in which a TI provider gains an understanding of context in decision making and is better able to determine information needs. In addition to required information, decision makers' feedback or requirements depending on the situation make it possible to generate situation-dependent information. In this way, the proposed TI process contributes to improving the value of TI. Furthermore, we considered a TI process from the service viewpoint and clarified that "Ba" is important for a co-creation of value between the decision maker and TI provider. When a TI provider understands context in decision making or when a decision maker understands the outcome of the TI process and carries out decision making, the decision maker and the TI provider share through "Ba" and gain a deeper mutual understanding. Finally, we clarified that the TI process based on a service viewpoint was effective for solving issues in a sample case involving a business that develops financial information systems. However, a more detailed analysis should be done to achieve a more effective TI process.

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