Knowledge Flow-based Business Process Redesign for Strategic Decision Making

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Abstract

Knowledge management and knowledge-based decision making process have long been endorsed as the methods for strategic management of companies. Managing a company based on knowledge is related with maximizing knowledge mechanism as well as sharing a variety of organizational knowledge (Suh et al., 2000). Therefore, a knowledge organization, which has the proper structure to facilitate knowledge dissemination and utilization, is equipped with knowledge flow-based business process (Choo, 1996; Mendelson et al., 1999; Yoo et al., 2001).

This paper suggests a methodology for knowledge flow-based process redesign, redesigning existing business process to be more flexible and effective with preserving the original goal of overall business process, because the business process is maintained with respect to the flow of knowledge that has the relationship of a cause and effect. Because the knowledge flow should be optimized to match the affiliated business process, 8 guidelines for flow optimization are proposed. To validate the suggested methodology and guidelines, a real reverse auction process is analyzed and redesigned.

The proposed methodology and guidelines play the role of a reference for managing the organizations dynamically and knowledgably to the changes of business environments. The combination of these two results can provide a firm with the foundation for competing and obtaining a competitive advantage with strengthening internal structure as the knowledge age organization.

1. Introduction

As the concerns for e-business and the Internet-based application systems are getting increased, practitioners have tried to verify how the business processes and organizational applications, such as information systems, policies, and strategies, etc., should be organized in order to obtain maximized returns. Integrating those concerns into one notion, they set a terminology as a business model, which integrates organizational resources and structures to manage ordinary business activities via the systems of e-business. Therefore, the decision making process in the era of e-business should be modified so as to include the concept of knowledge utilization, because the organizational characteristics and information system properties are tied to the unbounded systems thinking. In other words, organizations and their decision support systems must embrace procedures that can deal with this complexity and go beyond the technical orientation of previous DSS (Courtney, 2001). To respond to the unexpected changes of environment and the vast amount of information from it, the decision making process for recent organizations should equip the flexibility and adaptability in driving strategic decision.

Knowledge management and knowledge-based decision making process have long been endorsed as the methods for strategic management of companies. Managing a company based on knowledge is related with maximizing knowledge mechanism as well as sharing a variety of organizational knowledge (Suh et al., 2000). Therefore, a knowledge organization, which has the proper structure to facilitate knowledge dissemination and utilization, is equipped with knowledge flow-based business process (Choo, 1996; Mendelson et al., 1999; Yoo et al., 2001). Especially, the more company's anxiety for establishing the structure of e-business has increased, the more the need for maintaining organizational business process has increased, because the business process underpins company's competitiveness to be more flexible and dynamic to the business environment. To cope with the request for utilizing knowledge mechanism, a company that longs for facilitating e-business

systems should maintain, in advance, the internal and external business process with respect to the flow of knowledge. Therefore, the knowledge flow-based business process redesign elicits company's activities to be more proper and reasonable.

The knowledge-based decision making process differs from the conventional one in that it emphasizes the reusability of decision, because any kinds of decisions embrace the value of knowledge, which can be reused in a similar situation (Suh et al., 2000). Therefore, the knowledge-based decision making process requires the phase of synthesizing previous decisions with various related perspectives in a given situation (Courtney, 2001), and is established by smoothening the overall flow of knowledge that is required in each phase of making decision (Yoo et al., 2001). The resultant organization that guarantees the optimized flow of knowledge and that are underpinned by knowledge flow-based business process is stated as a knowledge organization (Yoo et al., 2002). Business processes of a knowledge organization are organized according to the optimized flow of knowledge that belongs to each phase of knowledge life cycle. Namely, the business process that is organized around knowledge flow forms the process model for the structure of a knowledge organization, which is imperative in the era of e-business.

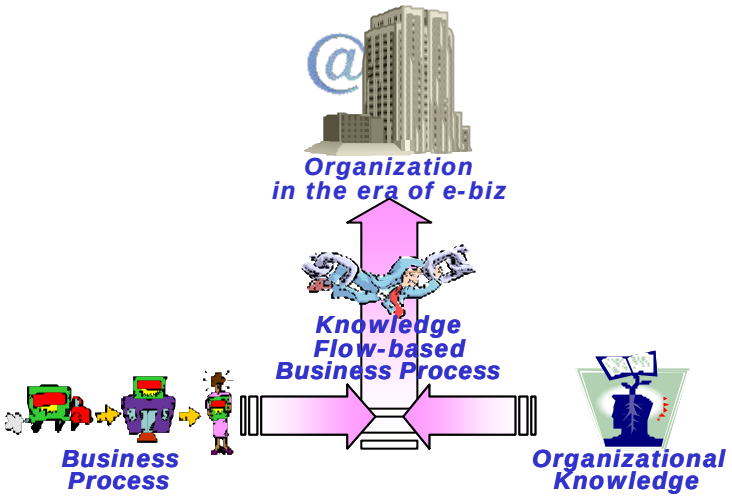


Fig.1 Research Background

The objective of this paper is to propose a methodology for business process redesign, especially focused on the flow mechanism of knowledge to fulfill a certain kind of business goal. To prepare the methodology, the business process is redesigned according to the affiliated knowledge flows, therefore, the business process can be optimized, if the flow of knowledge is optimized. To optimize the flow of knowledge, the knowledge should be organized as the form of data object and linearly sequenced as much as possible with the relationship of a cause and effect. In performing the overall procedures, several guidelines are required in analyzing and redesigning the flow, and this paper also suggests some guidelines for optimizing flow of knowledge, which is based in the previous research on business process reengineering.

This paper consists in three parts: the first part introduces the existing research concerning the way of performing business process redesign, especially focused on the application of knowledge flow. The second part suggests a methodology for knowledge flow-based business process redesign and some guidelines to optimize the knowledge flow, which guides the optimization of resultant business process. The last part shows the real application of suggested methodology and guidelines by redesigning a given business process, which is from a real company that serves customers using the Internet-based application systems.

2. Literature Review

2.2 Business Process Redesign

Aalst et al. (1996) proposed the process redesign method using high-level Petri nets based on the 'What, how and by whom' approach. This method is based on the process redesign guidelines presented by Hammer et al. (1993), as follows:

- The steps in a process should be performed in a natural order
- Avoid fragmentation of related activities
- If possible, several steps are combined into one
- If possible, tasks are allowed to be executed in parallel
- Avoid complex processes to cope with complex activities
- Reduce checks and controls as much as possible
- Make process generic, i.e. use multiple versions of the same procedure

- Check whether modern information technology allow you to omit steps

However, this study just focused on the application of high-level Petri nets on the process redesign, therefore just introduced how business processes could be modeled in Petri nets and be analyzed with taking into the inputs and outputs of a system consideration. In addition to this, when a re-designer selects a to-be process, s/he should choose the best process based on alternatives which were designed by rule of thumb, which was simulated through Petri net. Although this method can guarantees the validity of the chosen best process, it has the contradiction because the candidate processes are given based on the personal intuition, one is better than the other. Fig.2 shows the 'What, how and by whom' approach used in modeling high-level Petri nets.

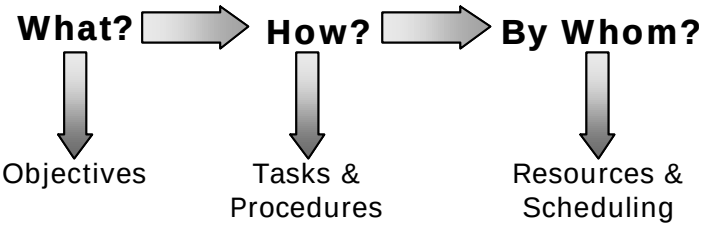


Fig.2 'What, how and by whom' Approach (Aalst et al., 1996)

2.2 Knowledge Flow

Knowledge flows play the key role in redesigning conventional business process and extracting general structure of a knowledge organization. Because Choo(1996) stated that the knowing organization possesses information and knowledge flows in the order of a cause and effect and Mendelson(1999) illustrated the flows of knowledge that is created in ordinary business processes form the upcoming structure of organizations, this chapter introduces the general aspect of knowledge flow.

(1) Reason for Importance

Schulz et al. (2001) explored knowledge management strategies, which are used to derive competitive advantage from the control and coordination of organizational knowledge flows. In this research, knowledge flows are strategically important to organizations for several reasons. First, knowledge flows transmit localized know-how, which is generated in one subunit to other locations in the organization. Second, knowledge flows facilitate the coordination of workflows linking multiple, geographically dispersed subunits. Third, knowledge flows can enable organizations to capitalize on business opportunities requiring the collaboration of several subunits. Knowledge flows are also crucial to the orchestrated execution of unified strategic responses to moves by competitors, customers, and suppliers. Finally, knowledge flows enable the recognition and exploitation of economies of scale and scope.

In addition, this research suggested an important means to effective management of knowledge flows is the codification of organizational knowledge. When organizations codify their knowledge, they package it into formats that facilitate knowledge transfer. Codification can be accomplished in a number of ways, such as encoding of organizational knowledge in formulas, codes, expert systems, 'spec sheets,' or budget information; expressing knowledge in natural language formats, such as reports, memos, or policies; embedding knowledge in physical objects, such as prototypes or technologies, or even depositing it in employees who visit or rotate between different subunits.

(2) Strategic Value

Holsapple et al. (2001) suggested a knowledge chain model that identifies and characterizes KM activities an organization can focus on to achieve competitiveness based on the Porter's theory on value chain to illustrate the strategic value of the knowledge flow. They point that, in spite of macro-level contentions and success stories, there has been little investigation of a systematic means for studying connections between KM activity and competitiveness. This research advanced a knowledge chain model that identifies and characterizes KM activities an organization can focus on to achieve competitiveness and identified the degree of competitiveness with the flow of knowledge flows within the activity boundary as Fig.3 shows.

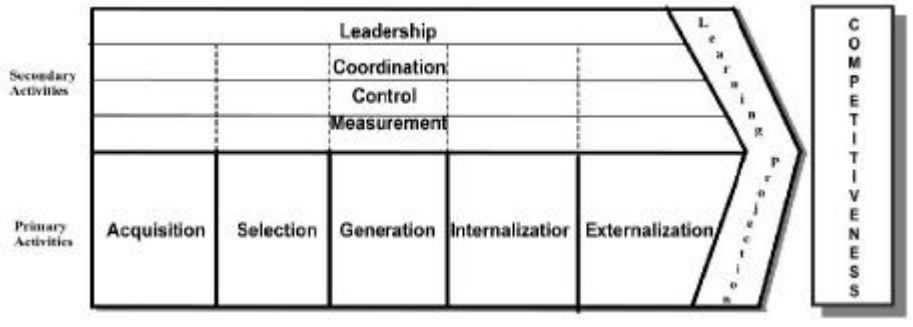


Fig.3 The Knowledge Chain Model (Holsapple et al., 2001)

The KM activities identified in the model are not the only determining factors that can lead to competitiveness. There are other forces that influence how the conduct of KM ultimately unfolds in an organization: resource influences and environmental influences. This suggests that the knowledge chain model could be extended to include resource and environmental factors, which both constrain and enable the execution of KM activities.

(3) Utilization

Adam et al (1995) analyzed the information practices of 16 executives for 4 organizations to verify the executives' decision making mechanism with the help of a framework designed to identify networks of information flow. This research aimed to develop information systems supporting top managers' strategic activities, Adam et al. initiated executives' information and communication flows into designing modules of decision support system. This research demonstrates that information or knowledge flow may guide the information system development with underpinning the user requirements.

Garcia-Flores et al. (2000) described an integrated framework for supporting supply chain management of process industries. Retailers, warehouses, plants and raw material suppliers are modeled as a network of co-operative agents, each performing one or more supply chain functions. Interactions between agents are made through the common agent communication language knowledge query message language (KQML) and data is modeled using standard exchange of product model data (STEP). In this study, information and knowledge flows between agents located in separated supply chain guide the integration of several supply chains, eventually result in effective supply chain management.

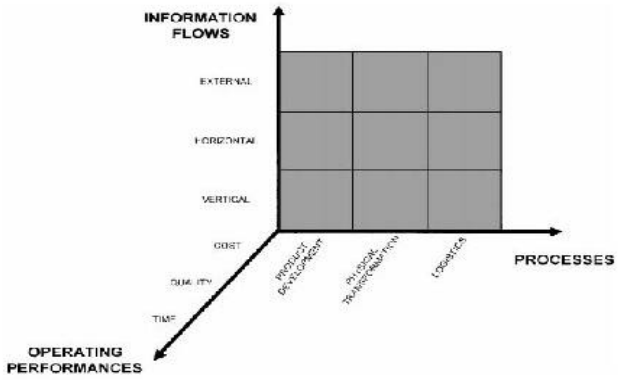


Fig.4 Framework of Information Flows for High Performance Manufacturing (Forza et al., 2001)

Forza et al. (2001) explored how the information and knowledge flows affect the high performance manufacturing best practices, such as just-in-time, total quality management, and concurrent engineering, etc. In this research, they developed a reference framework for the analysis of information flows in operations, and this reference framework integrated research in operations management and in organizational communication. Then they applied the developed framework to investigate how information flows tend to be characterized in high performance manufacturing. By doing so, the developed framework related cost, time and quality performances to three operational processes -physical transformation, product development and material flow management- and to three classes of information flows, such as vertical, horizontal and external information flows. Fig.4 shows the developed reference framework of information flows for high performance manufacturing.

Yoo et al. (2001) proposed knowledge flow-based decision making procedure, which modified the conventional decision making procedure, with deploying a knowledge base. Herbert Simon, the 1978 Nobel Prize winner in economic science, stated the importance of decision making as the synonym of management itself. Simon's decision making procedure consists in identifying the problem, designing alternatives and making decisions. Based on Simon's procedure for decision making, the conventional procedure is composed of problem identification, design of alternatives, choice of viewpoint, choice of related variables, experiment and measurement, evaluation of the results and choice of decision. Although this procedure underpinned scientific basis enough, in many cases, the resultant decision is chosen based on the executive's intuition, rather than following such a systematic procedure. Therefore, the conventional decision making process is intuitive, occasional and independent of the cases. Moreover, among the procedures, because choice of viewpoint and related variables involves a personal basis, the resultant decision is considerably subjective, unable to obtain objective fairness. Although the following ones of this procedure demonstrate the degree of objectiveness, because the starting point is biased, we cannot obtain a completely

effective decision. Probably, because of this defect in conventional decision making procedures, a variety of trials to establish decision support systems have failed.

As explained in the previous section on the definition of knowledge, knowledge is exhibited and embedded in a specific process, and the combination of process and knowledge as an object forms the resultant knowledge. Because of this aspect, as Demarest (1997) illustrated, knowledge is provisional, partial and muddled, however, counter intuitive rather broadly accurate. Therefore, imperatives or rules are essential components of knowledge-based decision (Demarest, 1997). Imperatives are behavioral directives that are unchallenged because they are derived from a firm's dogma. Rules are algorithms and heuristic logic models that define a basic set of guidelines for performing in particular environment or situation. Of course, there is a model base in the conventional decision support systems. However, the imperatives or rules that are included in the model base are dependent on the situation and environment, independent of the business process. Because a business process does not alter from situation to situation, the knowledge that is accommodated in the process is applicable to similar cases, so that eventually recycling and reusing all kinds of knowledge can be possible.

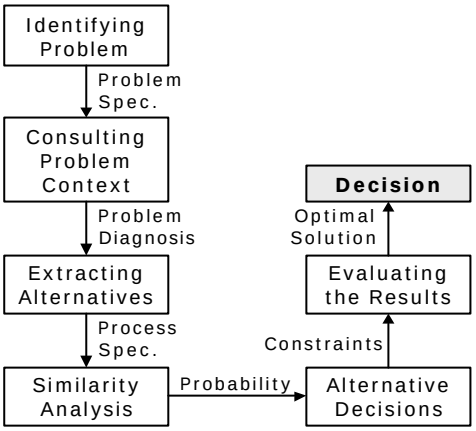


Fig.5 Knowledge-based Decision Making Procedure (Yoo et al., 2001)

Therefore, the conventional decision making procedure can be modified, by using the concept of knowledge management in terms of knowledge acquisition and recreation. The modified decision making procedure is given in Fig.5. It involves identification of problem, consultation of problem context, extraction of previous alternatives, similarity analysis of the case, choice of alternative decisions, and evaluation of results in deploying each decision. This procedure is similar to the scenario method in that extracting possible decisions and evaluating them. Because these decisions are based on the previous problem and process context, they bear plausibly realistic value and, consequently, are applicable to real business activities.

(4) Identification

Gordon (2000) built a knowledge map with respect to the knowledge links based on the learning dependencies between a variety of knowledge by performing interview with experts. Gordon stated knowledge mapping defined in his work used learning dependency to organize the map and modeled on the ideas of what knowledge is and on spatial representation structures. Knowledge maps can support metrics that provide information about the knowledge asset. Knowledge maps create a visible knowledge framework that supports the explicit management of knowledge by organization managers and directors.

Understanding is based on an ability to be able to provide justification for a belief. This process of showing why, relies on looking at the separate factors or prerequisite knowledge items that together provide supporting evidence for the new item. This new item of knowledge may introduce a new empirical factor but it is only necessary to show that this new factor is correct and has been rigorously derived, to be able to justify belief in the entire knowledge item. This is because it can be shown from previous learning that the other supporting pieces of knowledge can be justified. This supporting knowledge may itself rely on the justified belief in other items of knowledge and the whole structure may rely on some very simple facts which form a foundation for a whole area of knowledge. Clearly, the new knowledge item combines previous knowledge in some novel way, possibly using logic or mathematics to model the new situation.

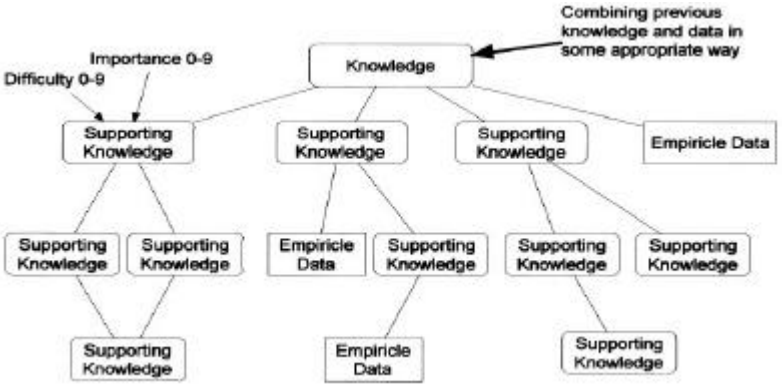


Fig.6 Knowledge Flow based on the Learning Dependency (Gordon, 2000)

Fig.6 shows what a knowledge network may look like. Understanding implies that the human expert knows why the supporting knowledge or empirical data is actually supportive of the higher knowledge item. Also contained within each link would be a measure of importance which shows how important each supportive piece of knowledge or empirical data is to the higher knowledge item.

3. Research Design

Fig.7 shows the overall procedure of this study. The procedure is somewhat similar that of study performed by Suh et al. (2000) in that it begins with process analysis and knowledge acquisition. After selecting target process and acquiring knowledge through interview with experts, knowledge flows are identified. Since the core part of the methodology for process redesign is the optimization of the knowledge flow, the identified knowledge flow should be optimized in advance. When performing flow optimization, a reorganizing methodology and guidelines are required. Then, based on the optimized flow of knowledge, each affiliated process is matched, and the redesign work is completed.

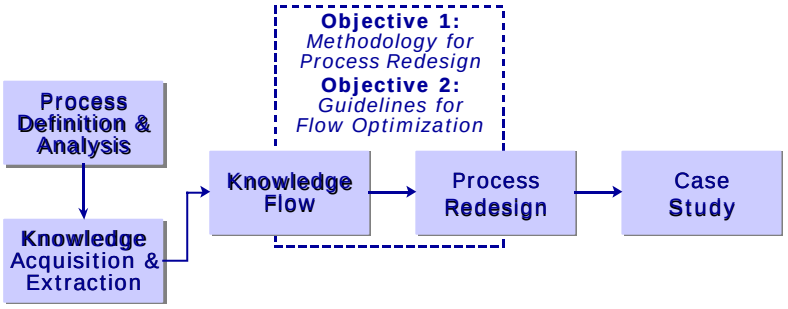


Fig.7 Research Procedures

In the above procedure, because this study focuses on process redesign, a methodology and guidelines for knowledge flow optimization is the core part. Although step of identification of knowledge flow takes importance part, because automated identification method has not been developed and because most of modern workflow systems use manually identified information and knowledge flows, this study also adopts the manual identification method as Agostoni et al. (2000) stated.

3.1 Identification of Knowledge Flow

There are several methods to identify knowledge flows of an organization. With automated identification methods, some kinds of pattern recognition methods such as case-based reasoning, clustering and neural networks, etc., can be applied, and with manual ones, questionnaire and interview methods can be applied. Among these methods, the selection of the proper one for identification depends on problem contexts and the process situation. However, for the general identification of knowledge during the scheduling and planning phase, questionnaire and interview-based knowledge map plays a core role in knowledge management (Suh et al., 2000).

Knowledge flows are different from process flows or workflows. Knowledge flows usually ignore the boundaries of activities, meanwhile process flows or workflows usually abide by certain boundaries. However, these days, this rule is broken as organizations perform their business dynamically with the use of information systems. Organizations perform their profit making activities interactively with suggesting and obtaining information and knowledge. Consequently, a new business process is created and managed around the flows of information and knowledge. Therefore, the identification of knowledge

flows is directly related to optimizing and redesigning business process.

Nowadays, workflow management systems are highlighted as information system for the next generation (Agostini et al., 2000). Various notions stress the beneficial aspect of workflow management systems. To summarize the basic concept of them, because of the ability to integrate all kinds of informative and knowledgeable resources around the specific business purpose, workflows are identified and managed through workflow management systems. To apply the workflow identification mechanism of workflow management to the procedure of identifying knowledge flow, this study adopts the methodology for building a knowledge map proposed by Suh et al. (2000). Because this map is based on business process and identifies the procedural relationship between all kinds of knowledge, it guarantees the exact identification of knowledge flow with respect to workflow management and the decision making procedure (Yoo et al., 2001).

3.2 Case Study

In this study, the case study takes the part of application exemplification and validation test. To apply the proposed methodology and guidelines, a real company's business processes are analyzed and redesigned. Based on the results of redesign, the performance of the proposed concept can be evaluated by using of some performance measures, such as time, cost, and the number of processing staffs. The processes to be exemplified are those of a service company, and are selected and applied with showing the characteristics of e-business application. The target process, the reverse auction process, reveals the unique characteristics of traditional business process to be optimized.

4. Knowledge Flow-based Process Redesign

4.1 Methodology

Once the flow of knowledge is identified according to the procedures illustrated in the previous section, the flows should be analyzed and optimized. This section suggests a methodology to optimize the given knowledge flow, as Fig.8 indicates.

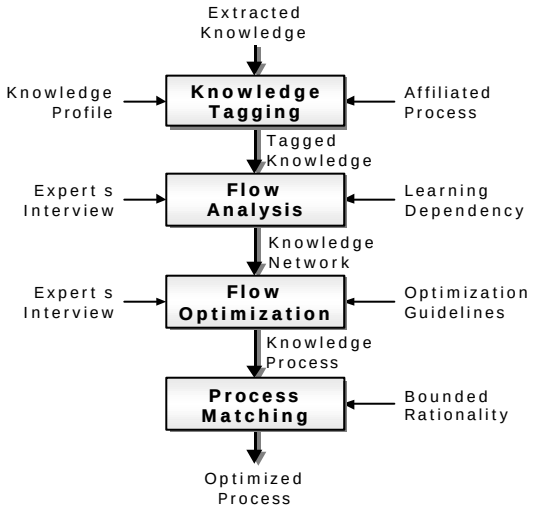


Fig.8 Process Redesign Methodology

(1) Knowledge Tagging

Process knowledge is originated and embedded in the business process. Therefore, the knowledge flow should contain the characteristics of business process with preserving the original goal of the process, as Aalst et al. (1996) indicated in the 'What, how and by whom' approach. In the procedure of tagging knowledge with affiliated process, acquired knowledge is labeled for the flows to preserve the original goal of the process. Therefore, the contents of the tags contain the attributes of the process, namely, they are similar that of knowledge profiles suggested by Suh et al. (2000). This kind of tag is also used when we design a workflow management system based on the knowledge-based system. Jablonski et al. (2001) used tags when they made knowledge particles be contained in knowledge carriers. [Table 1] shows the category attributes suggested by Suh et al. (2000).

[Table 1] Contents of Knowledge Profile (Suh et al., 2000)

	Contents available	Description
General Identifiers	Code	Numerical or alphabetical code for managing knowledge
	Title	Name of the knowledge
	Keyword	Representative words which show the summary of the knowledge

Utilization Identifiers	Form	Physical embodiment of the knowledge
	Location	Present place where the knowledge is used and being
	Experts	Experts of the knowledge
	Sources	Previous place where the knowledge is used
	Destination	Next place where the knowledge is used
Evaluation Identifiers	Importance	Subjective measures of how much the knowledge is important
	Utilization frequency	Objective times of the knowledge utilization
Content Identifiers	Summary	Brief summary on what the knowledge is
	Register	Person who register the knowledge on KMS
	Registration date	Date of the knowledge registration
	Modifying date	Recent date when the knowledge is modified
	Expiring date	Date when the knowledge is expired
Relation Identifiers	Linkage	Linking the knowledge with related kinds of knowledge in performing a specific activity
Security Identifiers	Authority	Limitation of users' approach to the knowledge for security

(2) Flow Analysis

Tagged knowledge should be arranged in the order of accomplishing the goal of the process. In arranging the flows, interview and modification with experts of the process should be performed to guarantee the function of the process. Although modern technologies concerning workflow management systems and knowledge based systems usually pursue the automated identification methods, such as case-based reasoning or genetic algorithms, modification and confirmation of experts should be performed as much as being automated (Suh et al., 2000). Therefore, the flows of knowledge should be arranged and modified by experts with abiding by the sequence that the process is activated to attain the original goal, because, in practice, simple and robust heuristics are most appropriate (Aalst et al., 1996). In this analysis, the degree of duplicated use of knowledge, complicated flow of knowledge, and redundant direction of flow is examined in term of performance measures, such as number of steps, number of prerequisite knowledge, and number of descendant knowledge, etc.

(3) Flow Optimization

To optimize the flow of knowledge, firmly certificated rules of guidelines should be deployed so that they can be applied to different cases. However, until now, general rules or guidelines for redesigning business process have not been presented, because way of process redesign can be diversified from case to case, namely, it is situation dependent. Therefore, it is no exaggeration that no certificated rules or guidelines for process redesign exist. Due to this fact, today, most of consulting firms do not open their own rules or guidelines to the public to obtain the uniqueness in performing process innovation projects.

(4) Process Matching

In this phase, business processes are matched according to the tagged knowledge and optimized flows. Nonaka (1999) explained those business processes that are facilitated and flexibly maintained through knowledge sharing as the knowledge process. Because the business processes are redesigned according to the optimized flow of knowledge, these resultant processes guarantee the maximized knowledge dynamics. However, one important considering point is remained. Although the processes are optimally redesigned according to the optimally maintained flow of knowledge, if the flow ignores the operation and business reality, then we should follow the real situation in which process is performed. In this case, we should consider the bounded rationality, which was explained by Simon (1957) as follows: the capacity of human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world – or even for a reasonable approximation to such objective rationality.

4.2 Optimization Guidelines

This study articulates several guidelines for flow optimization based on the guidelines suggested by Hammer et al. (1990; 1993) and Aalst et al. (1996). As illustrated in the previous section (Literature Review), Hammer et al. proposed some theoretical guidelines for process redesign. Meanwhile, Aalst et al. followed not only the Hammer's guidelines, but also new guidelines considering who is going to do the work and in what order based on the 'What, how, and by whom' approach, as follows:

- Reduce the number of people involved in the execution of tasks related on the job. Thus avoiding

communications and set-ups

- Tasks are performed where they make the most sense
- There should be a balance between specialization and generalization
- There should be a balance between centralization and decentralization

Based on these guidelines, this study suggests several new guidelines for optimizing the flow of knowledge. Because flow optimization is somewhat different from process optimization, in that the former must not exclude any of the associated knowledge but the latter may, guidelines for flow optimization are naturally modified so as to contain the concept of object-oriented modeling. [Table 2] explains the proposed flow optimization guidelines.

[Table 2] Flow Optimization Guidelines

Purpose	Title	Guideline
Diagnosis*	P1	Knowledge flow should be linearly sequenced as much as possible
	P2	Knowledge flow should not overrule the original flow of processes
	P3	Knowledge flow should observe the original goal of the process
	P4	Knowledge flow should not include redundant knowledge waypoint
	P5	Knowledge flow should not include conditional execution of knowledge as much as possible
Redesign**	P6	Knowledge flow should be reorganized from and around the core knowledge
	P7	Knowledge flow should be simplified by eliminating unnecessary parallel flow
	P8	Knowledge flow should be categorized into the goals of sub processes or tasks

*: Guidelines for analyzing and examining knowledge flows

**: Guidelines for redesigning knowledge flows

(1) P1: Knowledge flow should be linearly sequenced as much as possible

Although Hammer et al. (1993) pointed the steps in a certain process might be combined into one or executed in parallel depending on situations, the flow of knowledge should be linearly sequenced as much as possible, because duplicated utilization of knowledge and complicated flow of knowledge result in overall stagnation of knowledge mechanism. Therefore although the affiliated business process might be executed in parallel, the flow of knowledge within overall process should be linearly sequenced as much as possible.

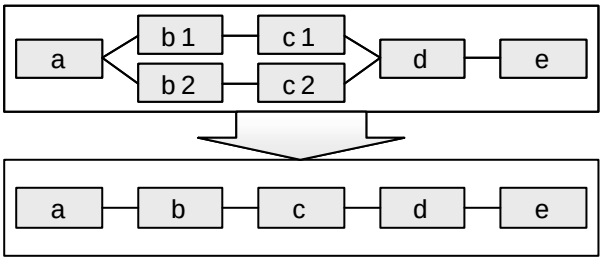


Fig.9 Example of Flow Optimization Guideline 1

(2) P2: Knowledge flow should not overrule the original flow of processes

Knowledge Flow is different from workflow or process flow, in that the former can intervene between other flows, however the latter cannot. If the flow of knowledge guarantees the sequence of original process flow, then, in the case of being redesigned, the flow keeps the way of activity completion that the original process has. Therefore, whether the flow of knowledge overrules the original flow of process should be examined in advance.

(3) P3: Knowledge flow should observe the original goal of the process

Sometimes, the original goal of performing the tasks of a process might be ignored because of the burden of flow optimization. In other words, although the flow of knowledge has not been optimized, if the conventional way of performing the process was the optimal one, then it would be better to observe the original goal and to persist the conventional flow of knowledge. As Aalst et al. (1996) stated, since the activity of process redesign is heuristic one, practitioners should consider

flow optimization dose not always guide the redesigned process to be optimal.

(4) P4: Knowledge flow should not include redundant knowledge waypoint

Once knowledge or information is inputted to extract certain decisions or policy, the flow between knowledge can be formed by revising the inputted knowledge, or prerequisite knowledge, to have the relationship of a cause and effect with other descendant knowledge in terms of learning dependency. Therefore, the flow between knowledge should not contain any duplicated and complicated use of knowledge, which is resulted from the redundant knowledge waypoint. To eliminate redundant use of knowledge, knowledge that has the same or similar contents should be integrated into representative one which contains overall contents of them.

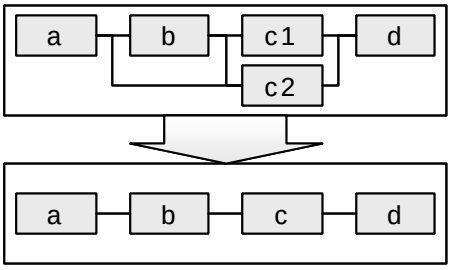


Fig.10 Example of Flow Optimization Guideline 4

(5) P5: Knowledge flow should not include conditional execution of knowledge as much as possible

Conditional execution of knowledge is indispensable, but, if possible, should be removed in order to guarantee the completion of given activity within a certain process. Conditional execution of knowledge, sometimes, halts partial termination of knowledge flow, as does deadlock situation in database. Therefore, if possible, conditional execution of knowledge should be removed and maintained to resolve the possible termination of entire flow of knowledge with reallocating knowledge or redirecting the flow.

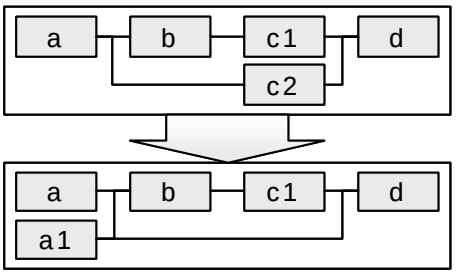


Fig.11 Example of Flow Optimization Guideline 5

(6) P6: Knowledge flow should be reorganized from and around the core knowledge

To perform the flow reorganization, a starting point should be prepared and the remaining activities are followed from and around it. The core knowledge can play the key role in reorganizing related flows of knowledge because it takes the core part to complete the process. Once the core knowledge is selected, then the flow can be identified with the relationship of a cause and effect. In a sense, because the flow represents the array of learning dependency between other kinds of knowledge, the repetitive identification of the relationship can form the network between knowledge.

(7) P7: Knowledge flow should be simplified by eliminating unnecessary parallel flow

Different from the flow of process, the flow of knowledge should be linearly sequenced as much as possible, because some parallel flows may cause duplicated use of knowledge and because, resultantly, halt overall knowledge facilitation. Therefore, although the process affiliated with the knowledge is activated in parallel, the knowledge should be integrated in order to prevent the flow from being shaped parallel. This integration can be achieved through migrating a new process to deal the compensation that which kinds of knowledge can be grouped as the similar contents.

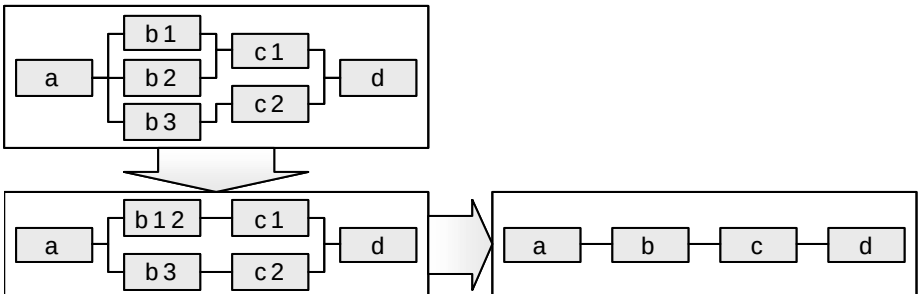


Fig.12 Example of Flow Optimization Guideline 7

(8) P8: Knowledge flow should be categorized into the goals of sub processes or tasks

To perform the flow optimization, besides selecting the core knowledge, the given flow of knowledge should be analyzed with extracting some problems within the flows. In performing flow analysis, it would be better to break down the flow because one set of knowledge flow is very large and complex. To break down the given flow, therefore, specific goals of each sub process and task yields quite good reference. Thus, to perform flow analysis, the given flow of knowledge should be categorized into specific goals of each sub process and task.

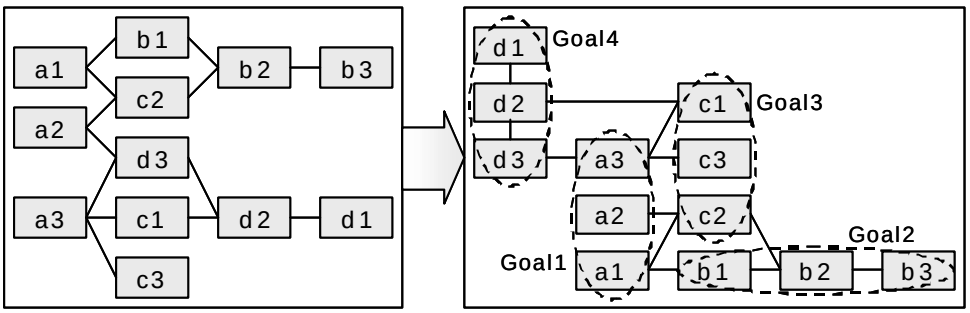


Fig.13 Example of Flow Optimization Guideline 8

5. Case Study: Process Redesign of a Service Company

5.1 Process Definition

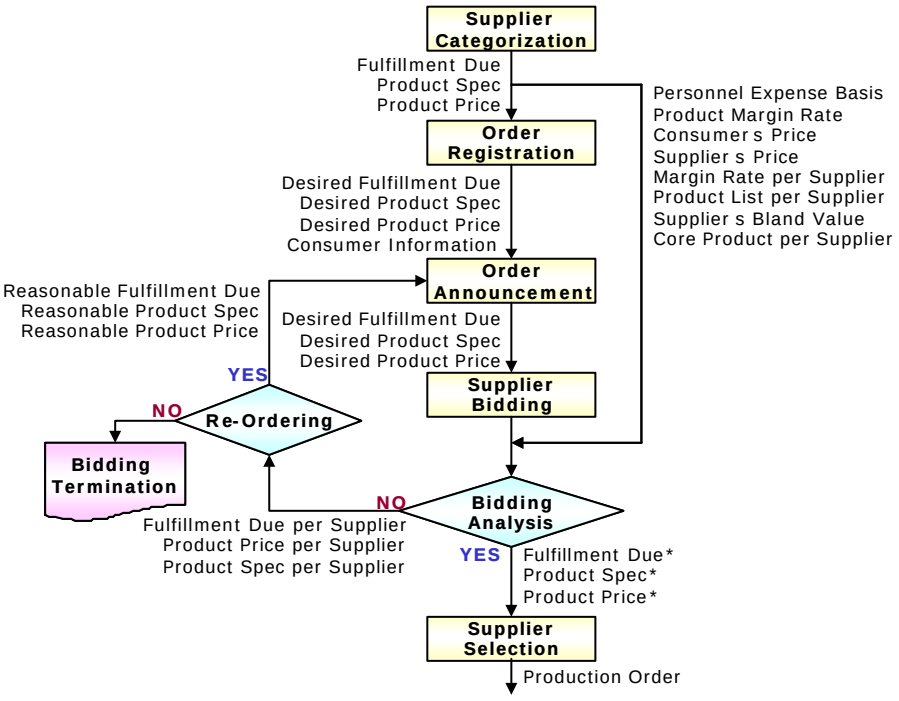


Fig.14 Conventional Reverse Auction Process

The process of a service company is selected because it is known that most of the service companies do not manage their business process optimally, and because the process is not well defined in spite of the vigorous interest in establishing business model nowadays. In this study, the reverse auction process of a wedding consulting company is chosen to apply the methodology and guidelines. The reverse auction service is one of the famous and popular services of recent service companies that perform customer service with the lowest cost and the best quality product, because the reasonable product

price and product specification can be obtained by direct and autonomous negotiation between customer and supplier. The main service of the selected wedding consulting company is scheduling and counseling wedding ceremony with helping customers save time and money for wedding. The exemplified company is BouWed Ltd. (www.bouwed.net) located in Seoul, Korea, and Fig.14 shows the reverse auction process of the traditional wedding consulting company, so was in BouWed.

According to the notions of the executives, they could not gain much profit through the reverse auction service, because few orders could be fulfilled with balancing the supplier's profit and customer's need. Most of the customers want to purchase the best products with the lowest price, but no suppliers intended to supply those products with that price. Therefore, the deals between suppliers and customers in the cyberspace could not be settled and negotiated. Namely, most of the orders of customers were not satisfied, and the reverse auction service did not attribute the profit of the company or suppliers. Based on the diagram describing the reverse auction process, knowledge flows can be identified as Fig.15 shows.

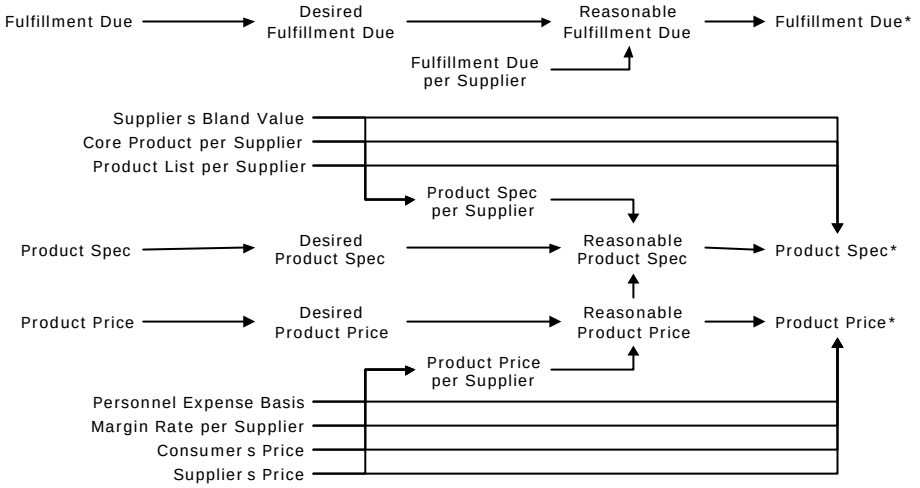


Fig. 15 Type captions below charts

5.2 Flow Analysis

To perform the flow analysis, flows should be categorized according to the goals of process (see P8), as Fig.16 shows. In the flows showed in Fig.15, 3 categories can be identified, order fulfillment duration, product price, and product specification. If we see inside of each category with respect to the diagnosis guidelines, some problems in knowledge flow can be identified, besides the problem of knowledge loss in customer information.

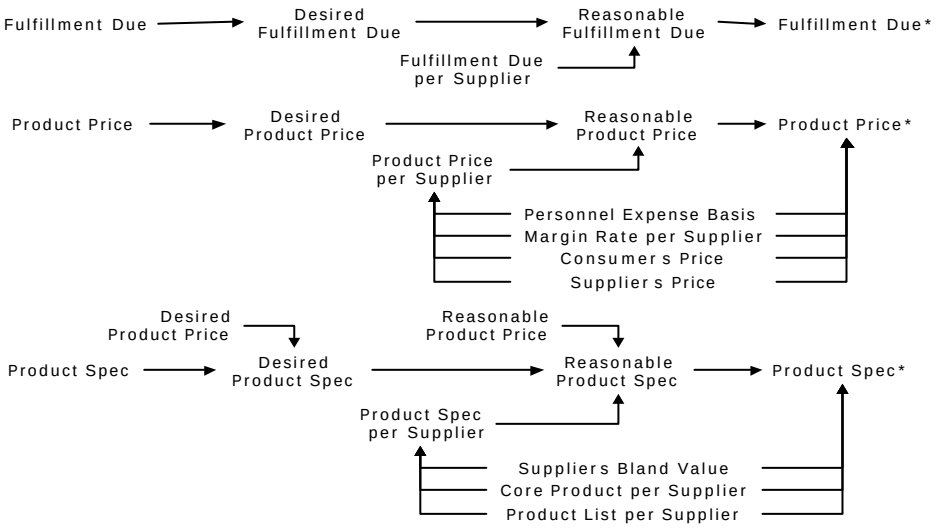


Fig.16 Knowledge Flow Categorization with respect to each Process's Goal

(1) Order Fulfillment Duration

There are 3 flows and 4 knowledge are involved in this process. It is clear that redundant waypoint knowledge is involved and that, as a result, redundant flows are identified (see P4). The flow can be simplified if the desired duration is modified so as to suppliers can be admitted.

(2) Product Price

There are various knowledge and flows involved in this process. The most critical problem in this process is there is conditional execution of knowledge, which results in termination of knowledge flow, eventually bothering the utilization and dissemination of knowledge between customer and supplier (see P5). This kind of problem occurs because customers do not know the suppliers' marginal product price that is the source of suppliers' profit.

(3) Product Specification

The knowledge flow in this process also reveals the same problem as does in product price process. In addition to this, the flow is more complex because desired price and reasonable price are added to determine the desired product specification and reasonable product price respectively. The flow should be modified not to halt on the way of flow.

5.3 Flow Optimization

To optimize the overall flow of knowledge, we should identify the core knowledge that is the most important in activating overall flows (see P6). Based on the flow analysis, we can identify that it is the product price that is suggested by customer and supplier. There are 3 knowledge concerning product price, and among these, the most significant one is the reasonable price because the overall flow of knowledge is dependent on the reasonable product price negotiated between customers and suppliers. Based on this viewpoint, brief discussion about the flow optimization is as follows.

(1) Order Fulfillment Duration

In this process, unnecessary knowledge waypoint and flow should be eliminated (see P4). Reasonable order fulfillment duration and supplier's order fulfillment duration are unnecessary, because, at any case, supplier tends to fulfill the customer's desired order fulfillment duration to attain the real customer satisfaction as well as own survival in the market. Therefore, the flow of knowledge can be shortened as Fig.17 shows.

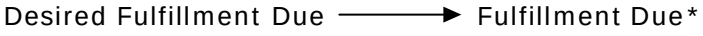


Fig.17 Flow Optimization in Order Fulfillment Duration Process

(2) Product Price

In this process, conditional execution of knowledge and flow should be maintained (see P5), and knowledge should be integrated in order to manage and to facilitate at the right source not to be wrongly modified (Hammer, 1990). Because the reasonable product price is set as the core knowledge, other knowledge should be organized from and around this one with adding the knowledge of customer information to obtain more reasonable one. As Fig.18 shows, all kinds of required knowledge for extracting reasonable product price are integrated and the conditional execution of knowledge and flow are eliminated, by reallocating the knowledge from supplier. To determine the reasonable product price, another process that considers the situation of both customer and supplier. By adding one task, the optimal reasonable product price that considers both sides can be extracted, and the task is performed by the mediator, who is familiar with both of supplier's intention and customer's need.

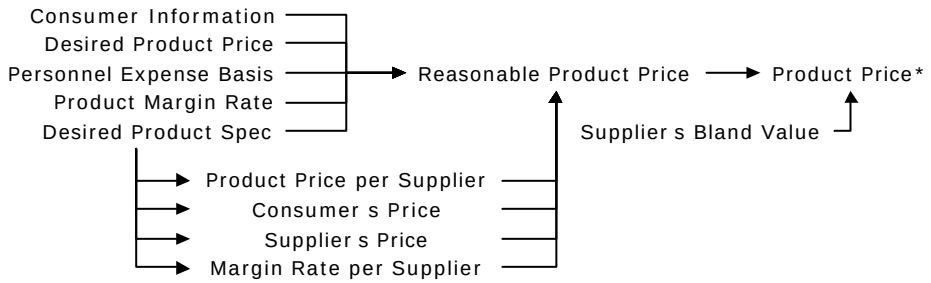


Fig.18 Flow Optimization in Product Price Process

(3) Product Specification

Because the core knowledge, reasonable product price, is obtained with considering the supplier's interest, selecting reasonable product specification becomes easier. In this process, conditional execution of knowledge and flow is also eliminated, by adding the task of mediator as is in product price process. Additionally, reallocating only the exact knowledge required to determine reasonable one results in more simple and short flows (see P7), as Fig.19 shows.

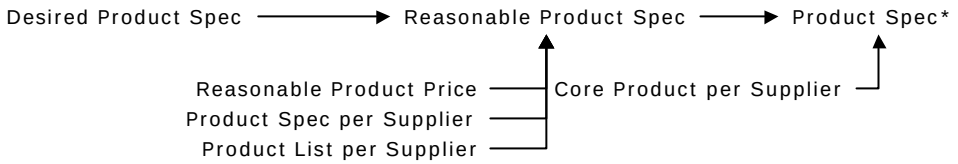


Fig.19 Flow Optimization in Product Specification Process

The overall flow of knowledge becomes quite simple and short at a glance as Fig.20 shows. The flow in this figure is organized based on the profile completed in the procedure of knowledge tagging that is the first procedure of the proposed methodology. This kind of organization of knowledge can be effectively utilized in the procedure of process matching because the knowledge in the flow follows the affiliated process.

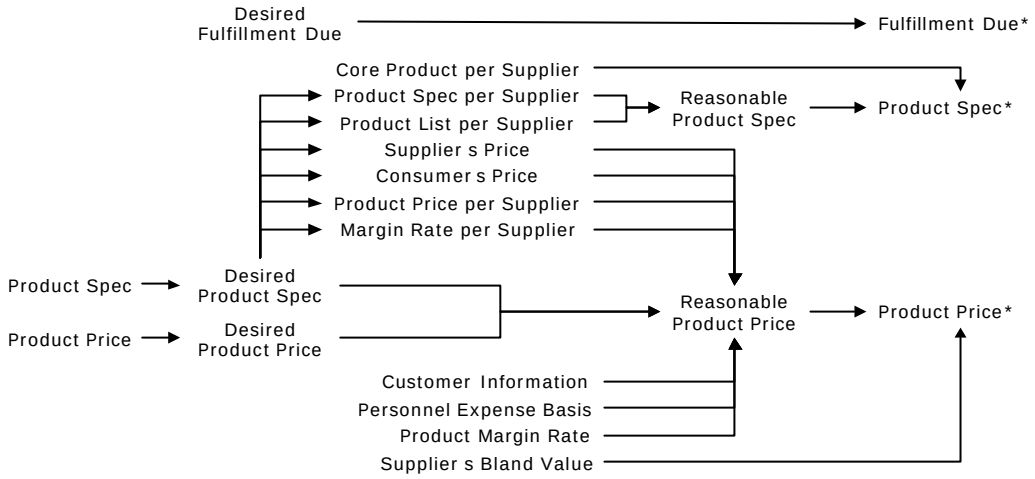
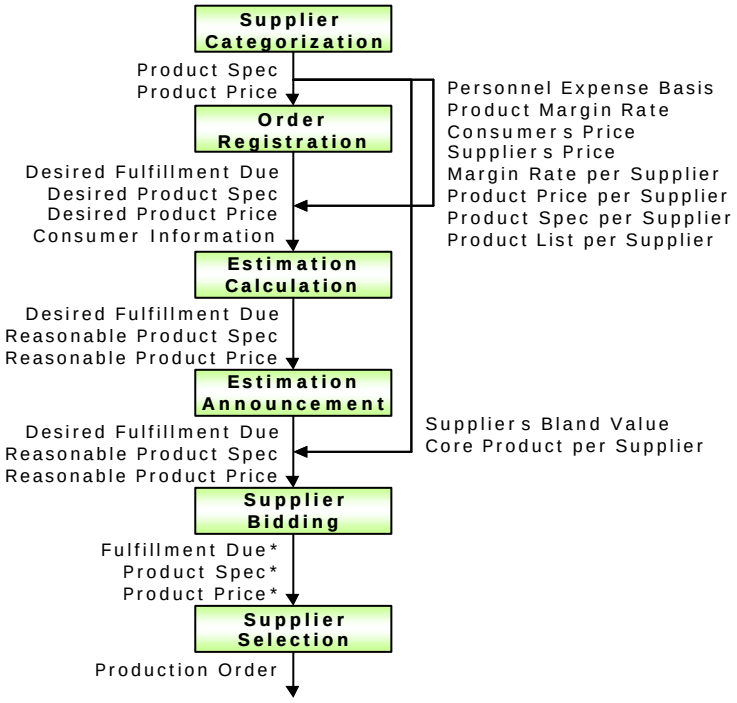


Fig.20 Overall Knowledge Flow Optimization

5.4 Process Matching

Fig.21 shows the matching of affiliated process with respect to the optimized flow of knowledge.



*: Optimized Condition satisfying Consumer s Requirement

Fig.21 Optimized Reverse Auction Process

As the figure shows the process is linearly sequenced (see P1) and the overall flow of knowledge is integrated before the core knowledge is extracted and activated. One important point is that a new process, estimation calculation, is

added. This process compensates the overall conflict between customer and supplier, because the estimation is calculated by a mediator who knows the desire of both sides. Generally the auction manager plays the role of mediator based on the customer's information and supplier's situation. Therefore, the process of reverse auction is activated by three kinds of actors, customer, mediator, and supplier. Furthermore, the objective of this process becomes clearer than before, and the knowledge sharing is promoted by the intervention of the mediator.

The performance of the optimized process dares to be evaluated as being outstanding. As the result of observation during the 6 months after the executives adopted the proposed process, with the role of a mediator is performed by one of existing wedding consultants, the success rate of the reverse auction deal has been raised up to 90%. 8 contracts have been completed out of 9 candidates, even the one contract that was failed was because of the customer's cancellation of marriage. Comparing to the previous situation that only 2 contracts were completed out of 15 candidates, the improvement in the contract success is quite excellent. The profit by the proposed process naturally has been increased about 30%. The reason for relative small increasing rate in the profit to the raising in contract success rate is due to the small margin in each deal. Although the process of estimation extraction by the mediator reduces the marginal profit rate of the supplier, the accumulative profit of supplier is guaranteed. The number of customers' orders is increased, because the product price is lowered and compensated optimally through the participation of the mediator.

As a result, the company is performing reverse auction service as one of the main services that attracts customers. Because the success story in reverse auction service is dispersed over the related suppliers and customers, more customers who want to experience the lowest price with the best product, and suppliers who want to supply their products with lower price and better quality, are being gathered now. The executive of this company states a true economies of scale in service industry can be accomplished within a few months, and a true customer service that pursues the true satisfaction of customers will be attained sooner or later.

6. Conclusion

As the changes of business environment and competition patterns within the environment become more accelerated, many firms try to maintain a more flexible organizational structure, as well as more adaptive to change. Maintenance of organizational structure means reorganizing a structure to be efficient and effective, as well as redesigning one's business process to be concise and straightforward. Through the optimized business process and organizational structure, firms can make multi-dimensional and transparent decisions, which contain organization-wide knowledge among all participants, with a focus on the exact business context. Therefore, knowledge-based decision making process is based on the knowledge network between those participants, namely, the knowledge workers.

In this study, to establish the knowledge network between knowledge workers, a methodology for redesigning knowledge flow-based process redesign is developed, and guidelines for optimizing identified flow of knowledge is suggested. The pattern of knowledge flow is similar to that of information workflow and it is underpinned with business processes. Therefore, when knowledge is identified as an object, its precedent and consequent knowledge are also identified according to the relationship of a cause and effect. Based on the identified knowledge flows, those flows and affiliated business process can be optimized. The resultant organizational structure is based on the mechanism of knowledge flow; that is, processes are organized around the specific knowledge that belongs to each phase of knowledge life cycle. The proposed methodology and guidelines need to be applied to a real case. In the case study on a service company, the business process can be redesigned and improved by applying the proposed methodology and guidelines. The monetary outcome and effectiveness in customer service are tremendously improved by the process redesign based on the proposed concepts.

A structural comparison with the structure of an education or a research organization, the typical examples of a learning and knowledge organization, should be performed to verify the resultant structure and its effectiveness. However, this study does not cover the structural comparison test, because the process redesign activity is time consuming activity enough. Further, the identification of knowledge flow through automated methods is more efficient and effective than the manual methods used in this study, especially when one considers the complexity of networked processes and the tremendous amount of knowledge that might be analyzed (Yoo et al., 2001). And also, to perform the validation test on the proposed concept, more scientific method should be used to demonstrate the performance. A simulation test examining the capacity of redesigned process would firmly demonstrate the validity of the proposed concepts.

The proposed methodology and guidelines play the role of a reference for managing the organizations dynamically and knowledgably to the changes of business environments. The combination of these two results can provide a firm with the foundation for competing and obtaining a competitive advantage with strengthening internal structure as the knowledge age organization.

References

[1] A. Agostini & G. D. Michelisa (2000), Light Workflow Management System Using Simple Process Models, Computer Supported Cooperative Work, Vol.9, 335~363

[2] C. Forza, F. Salvador (2001), Information flows for high-performance manufacturing, International Journal of Production Economics, Vol.70, 21~36

[3] C. W. Choo (1996), The Knowing Organization: How Organizations Use Information to Construct Meaning, Create Knowledge and Make Decision, International Journal of Information Management, Vol.16, No.5, 329~340

[4] C. W. Holsapple, M. Singh (2000), The knowledge chain model: activities for competitiveness, Expert Systems with Applications, Vol.20, 77~98

[5] E. Suh, K. Yoo, S. Kim (2000), Case Study on Applications of Knowledge Map Development Process in a Real Business World, Proceedings of KMIS/OA 2000, 399~403

[6] E. Suh, S. Youn, K. Yoo (2000), Development of a Methodology for Building a Knowledge Map, Proceedings of IFORMS/KORMS 2000 (CD Format)

[7] H.A. Simon (1957), Models of Men: Social and Rational, John Willy, New York (Quoted in the paper of Choo, 1996)

[8] H. Mendelson, R. R. Pillai (1999), Information Age Organizations, Dynamics and Performance, Journal of Economic Behavior & Organization, Vol.38, 253~281

[9] I. Nonaka, H. Dakeuchi (1995), The Knowledge Creating Company: How Japanese Company Create the Dynamics of Innovation, Oxford University Press, Oxford

[10] I. Nonaka (1999), Knowledge Management, 21st Century Books, Seoul (In Korean)

[11] J.L. Gordon (2000), Creating knowledge maps by exploiting dependent relationships, Knowledge-Based Systems, Vol.13, 71~79

[12] J.F. Courtney (2001), Decision making and knowledge management in inquiring organizations: toward a new decision-making paradigm for DSS, Decision Support Systems, Vol.31, 17~38

[13] K. Yoo, E. Suh (2001), A Study on an Organizational Structure for Facilitating Knowledge-based Decision Making, Proceedings of APDSI 2001 (CD Format)

[14] M. Hammer (1990), Reengineering Work: Don't Automate, Obliterate, Harvard Business Review, July/August, 104~112

[15] M. Hammer, J. Champy (1993), Reengineering the Corporation, Nicolas Brealey Publication, London

[16] R. Garcia-Flores, X.Z. Wang, G.E. Goltz (2000), Agent-based information flow for process industries' supply chain modeling, Computers and Chemical Engineering, Vol.24, 1135~1141

[17] S. Jablonski, S. Horn, M. Schlundt (2001), Process Oriented Knowledge Management, Proceedings of 11th International Workshop on Research Issues in Data Engineering 2001, 77~84

[18] W.M.P. van der Aalst, K.M. van Hee (1996), Business Process Redesign: A Petri net-based Approach, Computers in Industry, Vol.29, 15~26