Proposal of Issue Patterns for Business Process Design

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Abstract. To design business process, the pattern approach is a powerful tool. We generally design the business process in three steps – breaking down the enterprise goal into the process level, improving the process, and planning the information system. Generally, the design outcomes in the business process improvement are categorized in three themes - problems, issues, and solutions. Of these themes, the issues are not affected by the variation of each process, and the most suitable for the pattern approach.

In this paper, we propose the issue patterns, which are based on process phases and process types. We also evaluate this design method with the case study of the credit card issue process and show the effectiveness.

Keywords. business process, issue patterns, Balanced Score Card, Language/action perspective, process phase, process type.

1   Introduction

In developing a new enterprise information system, we usually take such a series of activities as breaking down the enterprise goal into the process level, improving the process, and planning the information system. In this paper, we call these three steps "business process design".

The persons named system consultants or system engineers are usually in charge of the business process design. This task is performed in corporation with the users and requires advanced analytical skills and creativity. The quality of the design highly depends on their ability level. As the theoretical system of the business process design is yet immature, the system consultants and the system engineers acquire their skills by experiencing much more cases. Therefore, it is important challenge to share both success cases and failure cases, and take advantage of them for the new business process design.

In the world of the software development, a pattern approach is adopted to share empirical cases effectively and efficiently [1]. The pattern approach is defined as abstracting, formalizing, storing and reusing the knowledge about recurring problems and solutions. So far, a variety of design patterns such as design pattern, analysis pattern, and architecture pattern have been proposed, depending on different design aspects.

In the world of the business process design, a variety of workflow patterns and workflow languages have already been developed. By applying the workflow pat-

terns, the third step of the business process design, the information system planning step, which is the closest to the implementation, has been supported effectively. Though, the other two steps have not been supported enough.

Generally, the design outcomes in the business process improvement are categorized in three themes - problems, issues, and solutions. Of these themes, the problems and the solutions are highly individual depending on their business environments. On the other hand, the issues are obtained as the root causes for the individual problems, so they are highly abstract. For the above reasons, in this paper, we will focus the issues and provide the patterns for the business process design. We also evaluate these design patterns by the case.

2   Traditional Technique

2.1   Business process design procedure

There are two kinds of roles – a customer and a performer. A customer is the person who requests the business, and a performer is the person who executes the business. A business process is a series of activities for the customer and the performer to compete the business. If the performer cannot complete the business by himself/herself, he commits some of his business to the third party. Such a process to complete the committed business process is called a sub process.

A business process design is breaking down the enterprise goal into the process level, improving the process, and planning the information system for the purpose of achieving the enterprise goal. In general, the business process design is performed according to the following three steps [7,8].

- Step1 Goal Breaking Down: We break down the enterprise goal into more concrete sub goals about customer satisfaction and productivity, and select the target process to be improved.
- Step2 Business Process Improvement: We improve the as-is process for the purpose of achieving the goal, and design the to-be process. Firstly we examine roles (customer and performer) and business events (request, agree, complete, etc.) about the target process. Next we clarify the problems to achieve the goal on the as-is process, analyze the causal relationship between problems, and find the root causes. Then we can obtain the issues by finding the opposite meaning of the root causes. For example, if the root cause is "too much cost", the issue is "cost reduction". Lastly we think out the solutions for the issues and design roles and business events for the to-be process applying the information technology, outsourcing, and so on.
- Step3 Business Process Description: We design the detailed specifications about the to-be process – the control flow and the input / output data. They become the basic specifications for the information system and the standard operating procedure for the operators.

We define the goal breaking down step and the business process improvement step "upper design process", and the business process description step "lower design pro-

cess". The main theme of the upper design process is to solve the business problems. In contrast, the main theme of the lower design process is to decide the specifications for the information system and the standard operating procedure.

2.2 Problems in traditional technique

(1) Pattern Approach in Lower Design Process.
The patterns of the lower design process are related to the flow control of the activities, and have been studied in the computer science field. Theses are in many cases based on the discrete event model theory, such as Petri Nets and Pi-Calculus.

YAWL (Yet Another Workflow Language) is a process description language, which was developed by Prof. Wil van der Aalst et al. [2]. YAWL is theoretically based on Petri Nets, and has basic patterns such as sequential, AND-split, AND-join, XOR-split, XOR-join. Moreover, YAWL has many kinds of applied patterns such as OR-split, OR-join, multiple instance task, composite instance task, cancelation region.

BPMN (Business Process Model and Notation) is a visual process language, which was developed by BPMI (Business Process Modeling Initiative) and OMG (Object Management Group), and also based on the Petri Nets theory. Like YAWL, BPMN has many kinds of patterns such as sequential, AND-split, AND-join, XOR-split, XOR-join, OR-split, OR-join, deferred choice, timer event, message arrival event.

As described above, the lower design patterns are very powerful in case of designing the specifications for the information system and the standard operating procedure for the operators. Though, it is not useful in case of improving the business process.

(2) Pattern Approach in Upper Design Process.
The patterns of the upper design process are related to the management problem solving, and in many cases based on the study of the business model in the field of the business strategy.

Business Model Canvas is a visual chart for developing new or documenting existing business models, which was developed by Alexander Osterwalder and Prof. Yves Pigneur [3]. It includes nine elements - Value position, Customer segments, Channels, Customer relationships, Cost structure, Key activities, Key resources, Key partners, and Revenue streams. Then five business model patterns modeled with the Business Model Canvas – Unbundling, Long Tail, Multi-Sided Platforms, FREE, Open Business Models are proposed.

Adrian Slywotzky, the consultant of Oliver Wyman indicated that it profit is more important than sales and market share, and proposed 22 patterns of business models based on the customer needs [4].

As described above, the upper design patterns propose the ideal types of the business process to realize the customer needs, and have a possibility to be used for improving the process. Though, they have problems as follows.
  i)   In the business process, many kinds of problems occur in complex. Therefore it is difficult to solve them only with the proposed design patterns.

ii) A problem needs a variety of solutions depending on the business environment. Therefore it is inefficient to propose the fixed design pattern for each problem.

3 Issue Patterns

As described in previous chapter, problems, issue, and solutions are the key items to be clarified in the business process improvement step. For each enterprise, business strategy, financial condition, target customers, business partners, organization structure, and management resources are different. Therefore, different problems occur even in the similar business process. In every enterprise, management problems are solved not from scratch, but on the assumption of existing organization structure and management resources. Therefore, different solutions are applied to the similar issue.

On the contrary, issues are obtained by analyzing the causal relationship between problems and finding the root causes. Therefore, issues are more general than problems and solutions, and have the possibility of being the patterns to support the upper design process.

In this paper, as follows, we classify the problems using the framework consisting of the process phase and the process type, and develop the issue patterns for each class. We select the process phases as an element of the framework, because issues will vary depending on the process phase. For example, in the sales management process, the issue in concluding contract and the issue in delivering product are completely different. We also select the process type as an element of the framework, because issues will vary depending on the business type. For example, the issue in the production and the issue in the sales are completely different. We will propose the issue patterns using this framework concretely as follows.

3.1 Issue patterns based on process phase

The research results of phasing the business process are surprisingly few. The most famous method of phasing the work is the PDCA cycle – Plan, Do, Check, and Action. Though, this phasing method is not intended for the collaboration works between the customer and the enterprise, the sales division and the production division, or the boss and the subordinate, but for the personal works.

Therefore, we phase the business process based on the theory of the language/action perspective [5]. In the language/action perspective, we consider the business process the conversation between the customer and the performer. We divide the business process into four phases – Preparation, Negotiation, Performance, and Acceptance, as described in Fig. 1. The state transitions among these phases are triggered by six business events – Request, Counteroffer, Agree, Report completion, Decline to accept, and Satisfied, as follows.

  i) Preparation phase: In this phase, the customer has not yet met the performer, and is preparing to request the work. In case of firing Request event, the preparation phase changes into the negotiation phase.

 ii) Negotiation phase: In this phase, the customer and the performer coordinate the condition of the work. In case of firing Agree event, the negotiation phase

changes into the performance phase. On the other hand, in case of firing Counteroffer event, the state change doesn't occur.

iii) Performance phase: In this phase, the performer performs the work on the condition – delivery time, cost, function, and so on, agreed by each other. In case of firing Report completion event, the performance phase changes into the acceptance phase.

iv) Acceptance phase: In this phase, the customer accepts the results of the work from the performer, and evaluates them. In case of firing Decline to accept event, the acceptance phase changes back into the performance phase. On the other hand, in case of firing Satisfied event, the acceptance phase changes into the preparation phase.
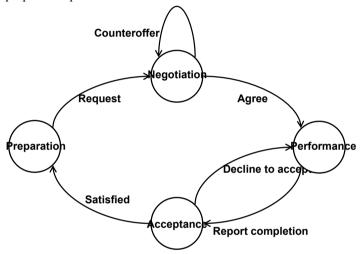

Fig. 1. Basic conversation model

We call this state transition model the basic conversation model.

By the way, the real business is not so simple to be completed only by one customer and one performer. In case that they cannot complete their tasks on their own, they commit some of their tasks to the third party person or organization. Therefore, the business process is modeled as the commitment network constituted by the basic conversation models, as described in Fig. 2. We call this network model CN (Commitment Network) model. In this model, we call the center conversation model the primary loop, and the peripheral conversation models around the primary loop the secondary loops.
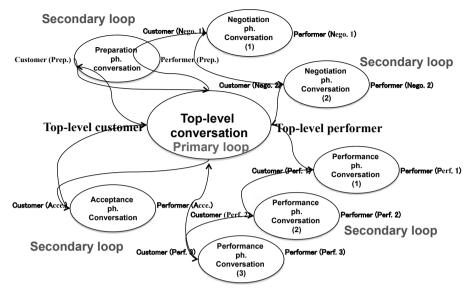
Fig. 2. CN (Commitment Network) model

Based on the CN model described above, the issues in the business process improvement are considered to avoid the breakdowns in the conversation. Therefore, the issue patterns are to make the chance that the customer meets the performer in the preparation phase, to mutually agree to the customer's expectation and the performer's responsibility in the negotiation phase, to fulfill the contract between the customer and the performer in the performance phase, and to make the customer satisfied to be the repeater in the acceptance phase. These issue patterns based on the process phase can be summarized as Table 1.

Table 1. Issue patterns based on process phase

Phase	Issue Patterns		Trust	Efficiency
Preparation	[Chance Making] Make the chance that C meets P.	Focus customers and their needs.	O	
		Plan products to satisfy needs.	O	
		Tell products information to customers.	O	
Negotiation	[Mutual Agreement] Mutually agree to C's expectation and P's responsibility.	Agree function and quality of products.	O	o
		Agree contract about products delivery.	O	o
		Share above information.	O	o
Performance	[Contract Fulfillment] Fulfill the contract between C and P.	Guarantee the function and quality.		O
		Fulfill contract about products delivery.		O
		Tell progress information to customers.		O
Acceptance	[Customer Satisfaction] Make C satisfied to be the repeater.	Correspond to defects seriously.	O	o
		Do maintenance for each customer.	O	o
		Provide new added value.	O	o

From this result, we can find the features about issue patterns as follows. Issues in the business process are classified into two groups – trust issues and efficiency issues. The trust issues are related to establishing the relationship of trust between the customer and the performer. The efficiency issues are related to increasing the performer's ability to do his/her work well. Table 1 shows that the issue patterns in the preparation phase are trust issues, and the issue patterns in the performance phase are efficiency issues. On the other hand, the issue patterns in the negotiation phase and the acceptance phase have the features of both trust and efficiency.

3.2   Issue patterns based on process type

Classification of business processes in the enterprise has been studied during the last twenty years. Of many kinds of research results, a BSC (Balanced Score Card) is best suited as a theory to be applied for developing the process type [6]. In the BSC, the business processes are classified by KPI (Key Performance Indicator), and the KPIs are typical issues to be achieved in the enterprise. Therefore, if we apply the BSC, we can take advantage of the KPIs as issue patterns. In the BSC, it is said that the business processes are classified into three types, as follows.

(a) Customer management

   The sales division in the enterprise builds the relationships with the customer and grows them. This type consists of four generic processes.
  - Select customer: identify the customer segments and create a brand image to appeal to these segments.
  - Acquire customers: communicate the message to customers and release/enhance the products.
  - Retain customers: ensure quality, correct problems, and transform customers into the loyal customers.
  - Grow customers: build the relationships with customers and increase the average sales per customer.

(b) Operation management

   The production division and sourcing division in the enterprise make the products or services and provide them to the sales division. This type consists of four generic processes.
  - Develop supplier relations: find effective suppliers to lower the total cost of ownership and establish the relationships.
  - Produce products and services: make products and services with efficient, high quality, and responsive process.
  - Distribute to customers: deliver products and services to customers efficiently, timely, and with high quality.
  - Manage risk: manage financial risk, operating risk, and technological risk.

(c) Innovation

   The marketing division and R&D division in the enterprise develop the new products, services, processes, or customer relationships, and provide them to the sales division or production division. This type consists of four generic processes.

- Identify opportunities: anticipate future customer needs and discover new, more effective, or safer products and services.
- Manage the portfolio: mix basic, breakthrough, platform, derivative, and alliance research project.
- Design and develop: define basic architecture, design products, and design production process.
- Launch: release products for initial ramp-up into commercial production.

Based on the BSC theory as described above, we can get the CN model of three business processes type as shown in Fig. 3. In this figure, the customer management process is arranged at the center. The innovation process contributes to the preparation phase of the customer management process, and the operation management process contributes to the performance phase.
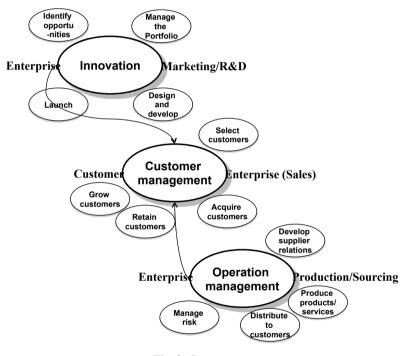

Fig. 3. Process type

Therefore, the issue patterns based on the process type can be summarized as Table 2. The issue patterns based on the process type can be also classified into trust issues and efficiency issues as well as the issue patterns based on the process phase. Table 2 shows that the issue patterns of the customer management type are almost trust issues, and the issue patterns of the operation management type are almost efficiency issues. On the other hand, the issue patterns of the innovation type have the features of both trust and efficiency.

It should be noticed that the process type looks like a fractal and in each process type the other process types appear. For example, the customer management process

usually has the credit control process, which is a kind of the operation management process.

Table 2. Issue patterns based on process type

Process Type	Process	Issue Patterns	Trust	Efficiency
Customer management	Select Customers	Understand customer segments	O	
		Screen unprofitable customers	O	
		Target high-value customers	O	
		Manage the brand	O	
	Acquire Customers	Communicate value proposition	O	o
		Customize mass marketing	O	o
		Acquire new customers	O	o
		Develop dealer/distributor relationships	O	o
	Retain Customers	Provide premium customer service	O	
		Create value-added partnerships	O	
		Provide service excellence	O	
		Create highly-royal customers	O	
	Grow Customer	Cross-sell customers	O	
		Solution selling	O	
		Partners with customers	O	
Operation management	Develop Supplier Relations	Lower cost of ownership		O
		Just-in-time delivery		O
		High-quality supply		O
		New ideas from suppliers		O
		Supplier partnerships		O
		Outsource mature unstrategic service		O
	Produce Products and Services	Lower cost of production		O
		Continuous improvement		O
		Process cycle time		O
		Fixes asset utilization		O
		Working capital efficiency		O
	Distribute to Customers	Lower cost to serve	o	O
		Response delivery time	o	O
		Enhance quality	o	O
	Manage Risk	Financial risk (high credit rating)		O
		Operating risk		O
		Technological risk		O
Innovation	Identify Opportunities	Anticipate customer needs	O	
		Discover new opportunities	O	
	Manage the Portfolio	Choose and manage mix projects		O
		Extend products to new applications		O
		Collaborate		O
	Design and Develop	Manage products through development stages		O
		Reduce development cycle time		O
		Reduce development costs		O
	Launch	Ramp-up time	O	
		Production quality, cost, cycle time	O	
		Achieve initial sales goals	O	

3.3   Process improvement procedure using issue patterns

We can improve the business process as follows using the issue patterns, which are based on the process phase and type.

(1) Make CN model and identify process phase

We make the CN model of the target business process and identify the process phase for each task. Firstly, we examine the work, goal, customer and performer of the primary loop. Then, we clarify six business events – Request, Counteroffer, Agree, Report completion, Decline to accept, and Satisfied, which invoke the phase transitions. Lastly, we decompose the work into some tasks, and arrange them as secondary loops on four phases – Preparation, Negotiation, Performance, and Acceptance.

(2) Identify process type

We identify the process type of the target business process using the CN model. If the external client - consumer, end-user, or dealer is the customer of the primary loop, the process type is maybe the customer management process. On the contrary, if the internal client – boss, executive, or the other division in the same company is the customer of the primary loop, the process type is usually the operation management process. In case that we cannot identify the process type only with the target process, we should try to make the upper level CN model, which includes the target process.

(3) Clarify issues

We clarify issues using the issue patterns based on the process phase (shown in Table 1) and the issue patterns based on the process type (shown in Table 2). The issue patterns based on the process type are related to the overall issues of the target process, and the issue patterns based on the process phase are related to the detail issues on each phase.

(4) Clarify problems

We clarify problems of the target process with reference to the issues clarified using the issue patterns. Traditionally, we clarify problems by listening to the concerns from stakeholders and analyzing them. Though, we sometimes miss the important problems with this approach for following reasons.

 i)   We cannot understand all the concerns of stakeholders, because we are amateur to their works.
 ii) Stakeholders cannot spell out all the concerns, because they are only in charge of small tasks.

To solve this problem, we apply issue patterns to clarify the problems. Namely, we prepare the candidate of the problems in advance using issue patterns, and listen to the concerns from stakeholders with reference to them. By taking this approach, we can avoid the mistakes when clarify the problems.

4   Evaluation

We evaluate the issue patterns proposed in the previous chapter using the case study of the credit card issue process.

4.1   Case study

A medium-sized credit card company D has the management goal of becoming the first-class credit card company. Therefore, the company D is trying to improve the credit card issue process as a part of this goal.

The procedure of the credit card application process is as follows.
- Applicant fills in the application form and submits it.
- The clerks of the company D examine the applicant's credit from the viewpoint of age, place of employment, income, and so on.
- If the applicant passes the examination, the clerks decide to make the credit card, register applicant's information to the DB, make the credit card and send it to the applicant.

The company D would like to shorten the lead time of the process from 20 days to 5, and reduce the number of workers from 80 persons to 20.

To clarify the problems and issues about the credit card application process, we apply the issue patterns approach.

4.2   Application of issue patterns

(1) Make CN model and identify process phase.

Firstly, we clarify the customer and performer of the primary loop. The customer is the applicant and the performer is the company D. Then, we clarify six business events. Request is to submit the application form to the company D, Counteroffer is to adjust the credit limit, Agree is to approve the admission, Report completion is to send the card to the applicant, and Decline to accept is to complain against the defect. Satisfied does not occur explicitly.
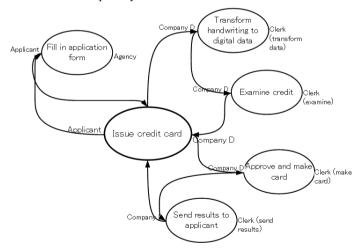

Fig. 4. CN model of credit card issue process

Lastly, we arrange tasks on four phases. We arrange "Fill in application form" task on Preparation phase, "Transform handwriting to digital data" and "Examine credit"

on Negotiation phase, and "Approve and make card" and "Send results to applicant" on Performance phase.

We can make the CN model shown in Fig. 4 by the procedure described above.

(2) Identify process type.

Because the customer of the credit card issue process is the applicant, this process may belong to the customer management process. The upper level processes including this process are shown in Fig. 5. The credit card issue process is one of the processes belonging to the customer management process, and is also in the performance phase of the "Acquire members" process, which is one-step upper level than the credit card issue process. Therefore the overall issues of the credit card issue process are related to the customer management process type issue patterns and the performance phase issue patterns. On the contrary, the issues on four process phases of the credit card issue process are related to each process phase issue patterns.
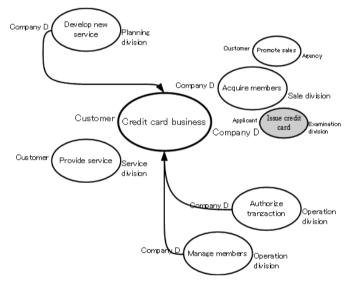

Fig. 5. Upper level of credit card issue process

(3) Clarify issues.

Firstly, we clarify the upper-level issues of the credit card issue process using the customer management process type issue patterns and the performance phase issue patterns, as follows.

<Upper-level issues>

By Process type issue patterns (Select customers):

- Understand customer segments.
- Screen unprofitable customers.
- Target high-level customers.
- Manage the brand.

By Process phase issue patterns (Performance phase):
- Guarantee the function and quality.
- Fulfill contract about products delivery.
- Tell progress information to the customers.

Next, we clarify the low-level issues using the process phase issue patterns, as follows.

<Low-level issues>

By Preparation Phase patterns:
- Focus customers and their needs.
- Plan services to satisfy needs.
- Tell services information to customers.

By Negotiation Phase patterns:
- Agree function and quality of services.
- Agree contract about services delivery.
- Share above information.

By Performance Phase patterns:
- Guarantee the function and quality.
- Fulfill contract about services delivery.
- Tell progress information to customers.

By Acceptance Phase patterns:
- Correspond to defects seriously.
- Do maintenance for each customer.
- Provide new added value.

Therefore, the issues of the credit card issue process are summarized in Table 3.

(4) Clarify problems.

We clarify problems of the credit card issue process with reference to the issues clarified in (3).

4.3   Discussion

To evaluate the effect of the issue patterns, we compare the results acquired by applying the issue patterns with the results acquired by the traditional method.

Table 3 shows the results by applying the issue patterns. 19 issues are acquired using the process type issue patterns and the process phase issue patterns. Of these issues 13 issues are related to trust issues and 6 issues are related to efficiency issues. On the other hand, Table 4 shows the results acquired only by interviewing the stakeholders and without applying the issue patterns. 12 problems are acquired and 6 issues are clarified by analyzing these problems. All the issues are related to efficiency issues and not to trust issues. We can see that the traditional method misses the issues belonging to trust issues perfectly. It is because the stakeholders notice the immediate problems, but do not notice the external problems.

Table 3. Issues of credit card issue process acquired by issue patterns

Level	Process Type/Phase	Issue Patterns	Trust	Efficiency
Upper-level	Customer management type in Overall process	Understand customer segments	O	
		Screen unprofitable customers	O	
		Target high-value customers	O	
		Manage the brand	O	
	Performance phase of Aquire members process	Guarantee the function and quality.		O
		Fulfill contract about products delivery.		O
		Tell progress information to customers.		O
Lower -level	Preparation phase	Focus customers and their needs.	O	
		Plan products to satisfy needs.	O	
		Tell products information to customers.	O	
	Negotiation phase	Agree function and quality of products.	O	o
		Agree contract about products delivery.	O	o
		Share above information.	O	o
	Performance phase	Guarantee the function and quality.		O
		Fulfill contract about products delivery.		O
		Tell progress information to customers.		O
	Acceptance phase	Correspond to defects seriously.	O	o
		Do maintenance for each customer.	O	o
		Provide new added value.	O	o

Table 4. Problems of credit card issue process acquired by interviewing

#	Problems	Issues
1	Applicants have to wait after the delivery time without any contact.	Progress management
2	Applicants cannot get quick answer for the query of progress.	
3	Applicants cannot stop the process in case of changing the contents of the application.	
4	Workers' motivation is reduced in data check and membership registration.	Efficiency improvement
5	Workload is high due to a large number of data check.	
6	Exam1 and Exam2 are performed sequentially in spite of no ordering constraints.	Paperless
7	Feel stress to sort a large amounts of documents in preparing the examination.	
8	It takes time and effort to request the data input.	On-line
9	It takes time and effort to request the credit investigation.	
10	Invest1 and Invest2 are performed sequentially in spite of no ordering constraints.	
11	Examination is a hard work because of a variety of difficulties mixed.	Quality improvement
12	Making card must wait for Examination because of 5% of unacceptable applicants.	Shorten delivery time

As described above, we can confirm that the issue patterns have the power to avoid missing the issues to be clarified in the business process improvement.

5   Conclusion

In this paper, we proposed the issue patterns, which are the knowledge base of the typical issues to be solved in the business process improvement. We adopted a language/action perspective as the framework of the process phase issue patterns, and a balance score card as the framework of the process type issue patterns.

We applied the proposed method to the case study of the credit card issue process, and confirmed the effect. In future, we will enhance the issue patterns to link to KPIs, and automate clarifying problems and issues of the business process. This work was supported by a Senshu University research grant in 2012.

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