

## The incremental goal evolution process methodology

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**Abstract.** This paper proposes the incremental goal evolution process methodology from the view point of the approach to business process optimization. This paper first presents a procedure for proposed methodology, which is composed of 6 steps. An actual business process of industrial factory is analyzed by adopting this methodology in on-site case study. the result of case study indicate that proposed methodology is contribute to evolving both goal and business process by analysis of business process–data. This paper finally indicates validation of the methodology and future work.

### 1 Introduction

In Requirements Engineering (RE), Identify and Define a goal (objectives of the business) is important as an approach to improve business processes. Recognizing this need Goal oriented analysis has been proposed [1]. The i\* Framework describes a Strategic Dependency model among goals and tasks. This framework helps understanding the current business processes and analyzing the effect to the information systems implementation. [2]. The NFR (Non Functional Requirement) framework is used for soft-goal analysis. This framework assists understanding causal relation of the goals which are not quantitative [3]. The KAOS (Knowledge Acquisition in automated Specification) helps quantitatively verifying whether a goal is attained [4].

However in the situation which business and system environment change at a rapid speed, the goal defined once is seldom maintained permanently. It is important that goal is incrementally changed (evolve) corresponding environment changes. It is necessary to effectively and correctively improve business processes based on goal changes. In this paper we will propose a methodology for evolving goals and business processes together incrementally.

## 2 The incremental goal evolution process

The Business Process Management (BPM) methodology improves business processes [5]. Fig.1 overviews steps of the methodology. First a present business process (as-is model) is defined. Next goal is analyzed. And finally to-be model is designed based on the goals and business processes which improve the as-is model. This business process improvement is repeated continuously.

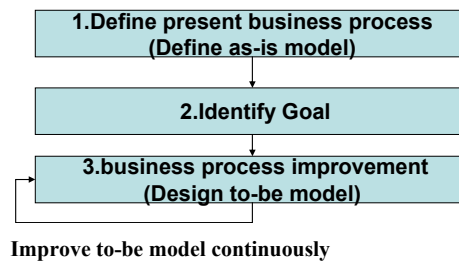


Fig. 1. Steps of BPM methodology

In this methodology, goals are made by the interview and discussion with the person in charge of the business. However checking the validity of goals and reviewing the goals aren't mentioned closely. So we propose new methodology which includes steps of checking and reviewing goals. Fig.2 shows the steps of the proposed methodology.

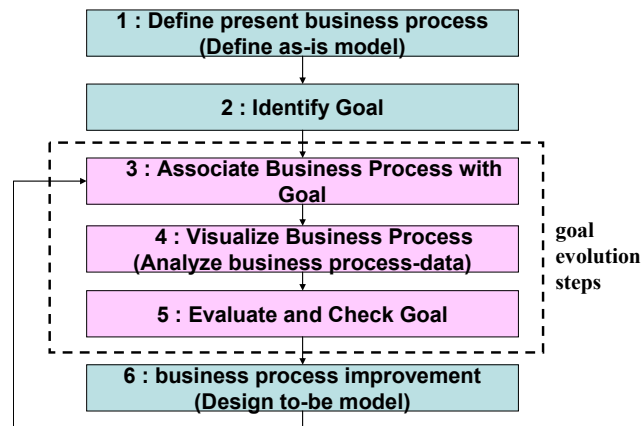


Fig. 2. Proposed methodology steps

### Step 1 - Define present business process (Define as-is model).

Identify actors and event (activity) in the business process and its boundary. Identify material and information in the business process.

### Step 2 - Identify Goal.

Identify a goal to be attained by the business process. Then, the function (hard-goal) which is necessary for the goal is considered.

**Step 3 - Associate Business Process with Goal**

Associate business process with the goal. And Identify actors which have responsibility for the goal by business process–actors association.

**Step 4 - Visualize Business Process (Analyze business process-data)**

Collect and evaluate business process-data. Business process data, it points at the data by measuring the performance of the work in the business process. For example “Process start-time”, “Process finish-time”, “Movement start-time”, “Movement finish-time” and so on.

Then visualize (analyze) business process by business process-data.

**Step 5 - Evaluate and Check Goal**

Check and evaluate the goal based on the analysis of the business process in step 3. And change the goal identified by step2.

**Step 6 - business process improvement (Design to-be model)**

Improve business process in accordance with the goal reconsidered in step 5. Then, Return to step 3 again. The step 3 through step 6 repeats continuously.

**3 Case study**

This section describes a case study applying the incremental goal evolution process. We adopt it to business process at an industrial factory which manufactures automobile parts.

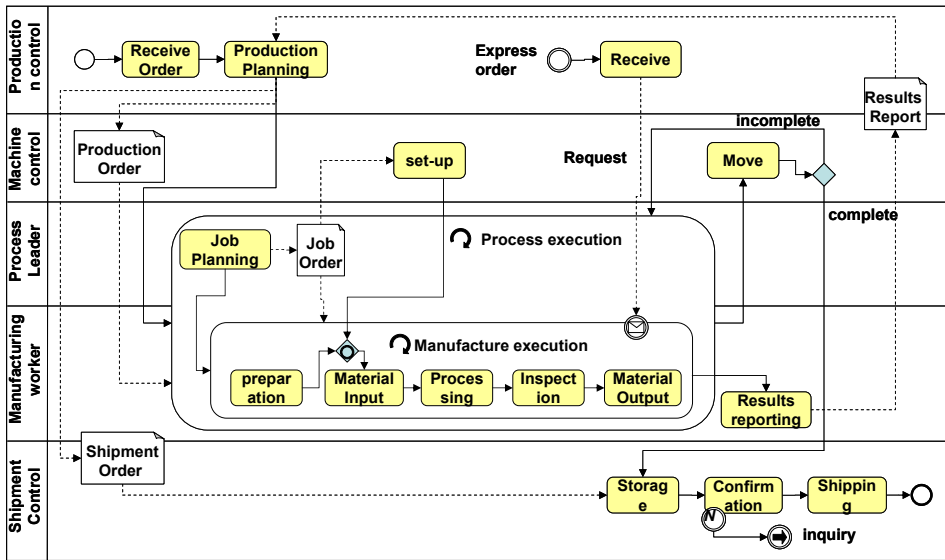


Fig. 3. Current business process (as-is model)

**Outline of business process:** the production control person who took an order from client does production planning and shows “production order” to leaders of each process. The leader does job planning and shows “job order” to the manufacturing worker and the machine control person. The machine control person does set-up of the machine in accordance with the kind of materials. The manufacturing worker prepares materials and manufacture (processing, inspection) after set-up is completed by the machine control person. When finished, the machine control person moves materials to the next process. When product is completed by passing through processes, the shipment control person confirms product with reference to “Shipment Order” and finally ship to client.

**Step1 - Define present business process (Define as-is model)**

BPMN (Business Process Modeling Notation) is used in this paper as a notation of business process [6]. The diagram is shown in the Fig.3.

**Step2 - Identify Goal**

Fig.4 shows soft-goal interdependency graph developed based on discussions with actors.

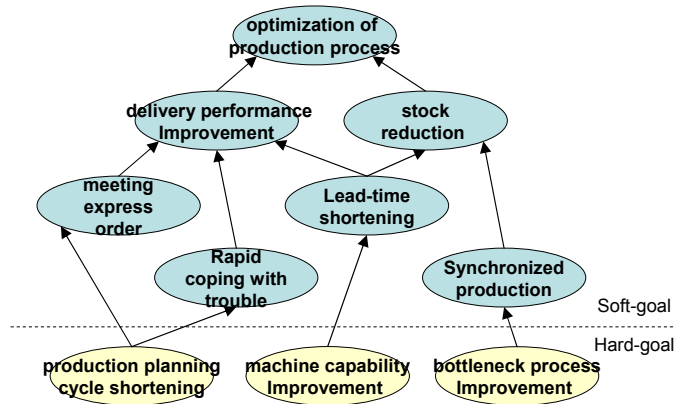


Fig. 4. Soft-goal Interdependency graph by step2

**Step3 - Associate Business Process with Goal**

In this step we aim to confirm consistency of business processes and goals. This association between business process-goal and goal-actor will become guidelines to interview the person in analysis of business processes. The result of this step is omitted in this paper.

**Step4 - Visualize Business Process (Analyze business process-data)**

Although business process was defined in step 1, it only explained the overview structure of business process. In this step actual business process-data is collected and analyzing the business process. For acquisition of business process-data we used RFID-tag attached to Job order sheet (show Fig.5). RFID-tag is contributed to minimize work load and accurate data collecting. The examples of analysis technique of business process-data are described as followings.



Fig. 5. RFID-tag attached to Job order sheet

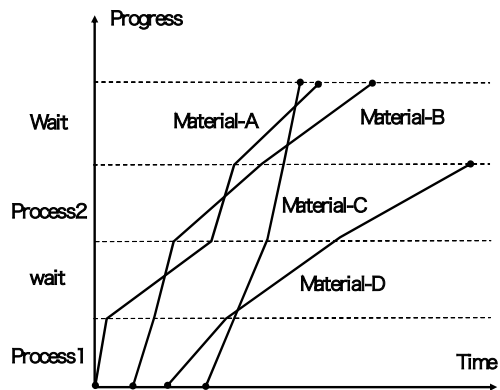


Fig. 6. Trace graph

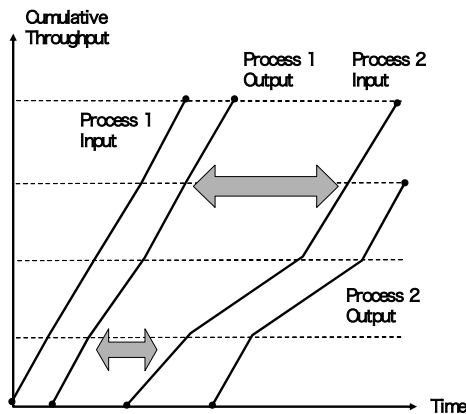


Fig. 7. Accumulation graph

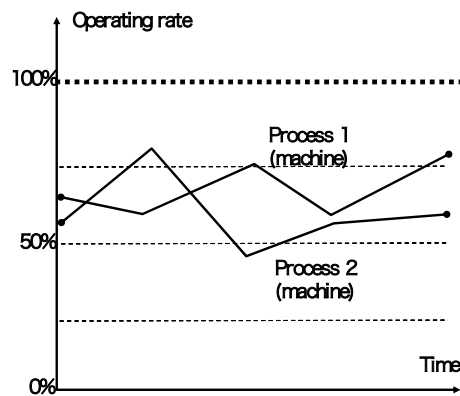


Fig. 8. Operating time graph

**1. Trace graph (Fig.6):**

The trace graph paid attention to each material and progress result of which is showed by time transition (x-axis). The y-axis of trace graph shows the progress conditions of the subject (Material). "Process1" and "Process2" shows the conditions that a subject is being processed (manufactured). "Wait" shows that a subject is accumulated be-

tween the processes. By this we know the point where the material flows becomes complex and where material flow sequence become changes and so on.

**2. Accumulation graph (Fig.7):**

The accumulation graph paid attention to each process and Cumulative throughput of which showed by time transition (x-axis). By this we know point which is a bottleneck process and which is instability of process throughput and so on.

**3. Operating time graph (Fig.8):**

The operating graph paid attention to operating time of each process and operating rate of which showed by time transition (x-axis). By this we know which process is always low operating rate and always low operating rate and so on.

**Step5 - Evaluate and Check Goal**

Considerations are made using graphs, mentioned above. These graphs visualize business process-data. The improved goals after the step of evaluation and check are shown in Fig.9.

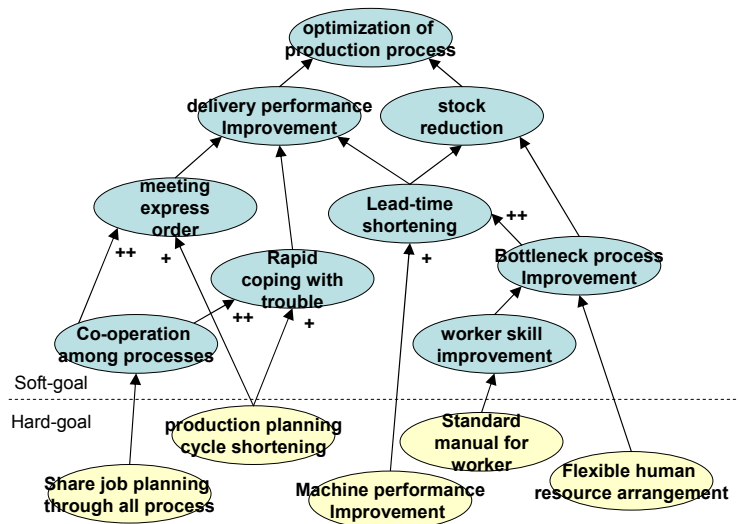


Fig. 9. Soft-goal Interdependency graph by step5

**1. Considerations by Trace graph:**

It became clear that material flow of order changes frequently among whole process. By interview with leaders of each process they don't share planning information during each process and therefore job plans are made individually by each leader. Because of that, when express order and trouble occurred, they couldn't cope with it. So it can't hope for the great effect even if hard-goal "production planning cycle shortening" is realized. We create new soft-goal "Co-operation among processes" and new hard-goal "Share job planning through all process"



#### 4 Conclusion and future work

We propose a methodology of the continuous goal evolution process toward the optimization of the business process. The methodology is also applied to the actual business field, and evaluated. The Advantage of the proposed methodology is the goal check step using business process-data which could gather from the actual environment of the business. This will help business process improvement.

Although the methodology is able to apply all the business processes, it could hardly apply to creative processes that have no obvious steps. For example Research and Development, Product Planning, marketing have remain ambiguous human activities. And the proposed methodology needs more actual usage in case study to gain experience with strength and weaknesses of methodology.

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