Defect Prevention Review by Process Relationship Matrix

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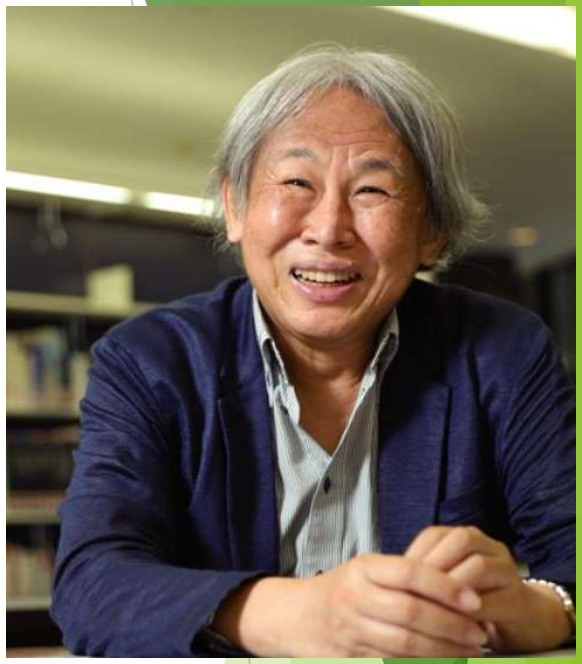


- He received the B.S. degree from Nagoya Institute of Technology and the M.S. and Dr. Eng. degrees from Nagoya University in 1977, 1979, and 2000, respectively.
- He joined Nippon Telegraph and Telephone (NTT) in 1979 and moved to NTT DATA in 2002. He became the first Fellow of NTT DATA in 2007. He moved to Nagoya University as a professor in 2009.
- He is currently an emeritus professor of Nagoya University and professor of IPUT in Nagoya.

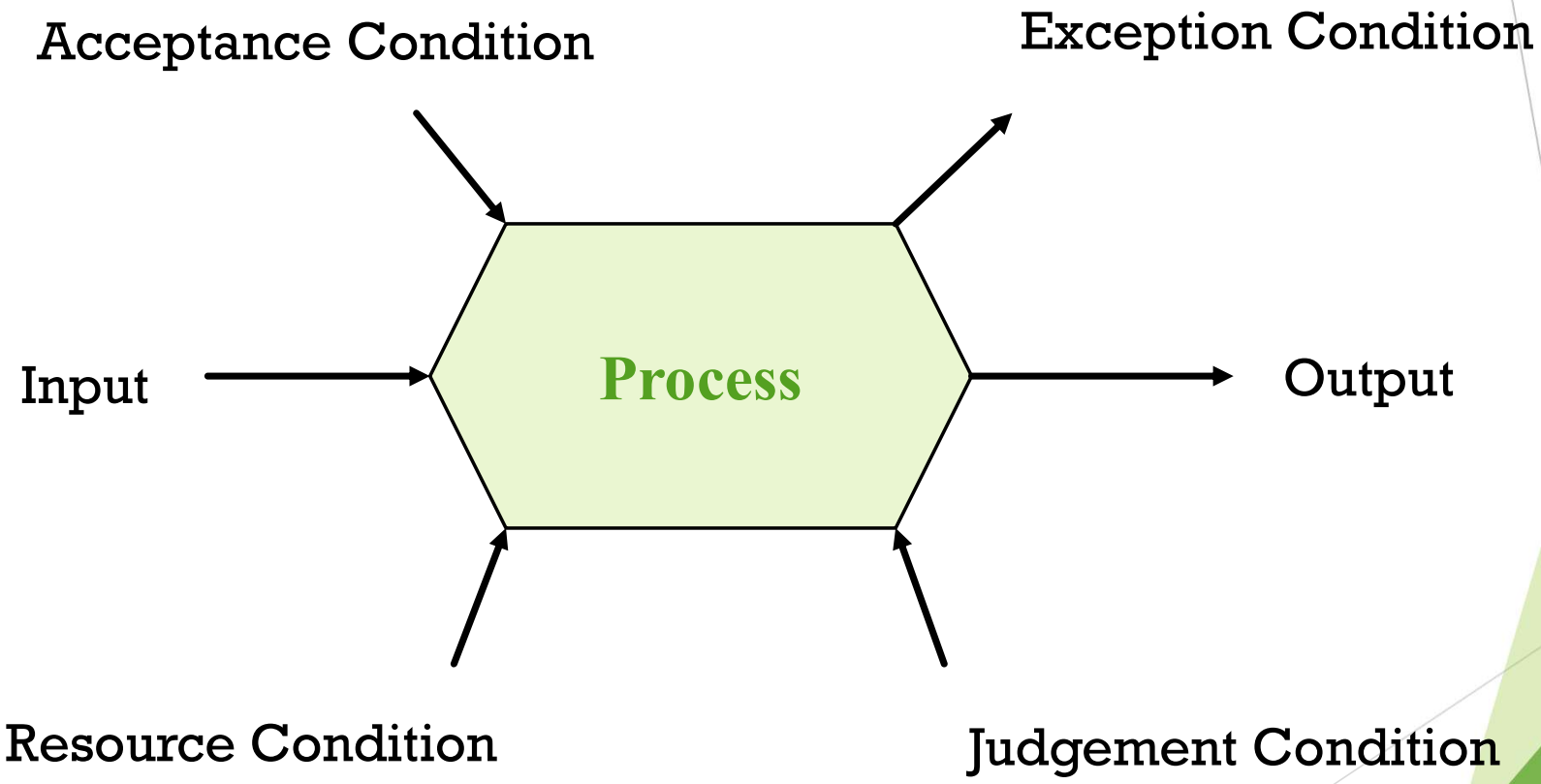
Overview

- To clarify business process completeness, we proposed a business process diagram that describes six aspects: input, output, accepting conditions, resource conditions, exception conditions, and judgement conditions.
- By separating exception conditions from the output, the proposed diagram has the advantage of making it possible to detect and respond to defects and extract exception handling knowledge.
- The procedure for reviewing the diagram has not been specified. In this paper, we define a process relationship matrix to demonstrate a step-by-step review procedure for preventing defects in business process diagrams.
- The main output of the paper is the business process review method using a process relationship matrix.

Related work

Approach	Overview	Authors
BPR Business Process Reengineering	Forget what you know about how business works, because most of it is wrong	Hammer & Champy
FBCM Fact Based Collaboration Modeling	Objective BPR method based on statistical analysis of BSC and field data	Kokune et al.
IDEF0 Integrated DEFinition	Functional connectivity is described using four arrows: input, output, control conditions, and mechanism conditions.	IEEE
BPMN Business Process Modeling Notation	A diagrammatic language for business processes that can describe logical and strict control conditions	OMG
OPM Object Process Methodology	Describe the system in terms of object requirements, physical objects, and definition, realization, and implementation processes	Dori
Mono-Koto-Analysis	Eliminate waste with the Mono-Koto Analysis Diagram that views works and objects of works	Nakamura
Ji- Koutei-Kanketsu	A method that optimizes the entire production process, not just a specific process by using business process diagrams and requirements organization sheets	Sasaki Toyota

Defect Prevention Diagram Process



Defect Prevention Conditions

- If the acceptance conditions are not satisfied, the process will not start.
- Unless the resource conditions are satisfied, the process will not start.
- If the result of the process does not satisfy the judgment conditions, it will not be output.
- Generates an exception condition when the process cannot start or when the output does not satisfy the judgment conditions
- When the resource conditions are satisfied for the input that satisfies the receiving conditions, generate an output that satisfies the judgment conditions of the process.

Defect Prevention Diagram Creation

[Step 1] Identify the business process and name the business action.

[Step 2] For the business process, connect a flow relationship from the output of the preceding business to the input of the succeeding business. At this time, the input and output for the business process are named.

[Step 3] For the business process, identify the receiving conditions, resource conditions, and judgment conditions. For cases where these conditions are not met, extract the exception conditions.

[Step 4] Add an exception flow that connects the extracted exception conditions to the input conditions of the appropriate business process. At this time, if there is no business process to connect the exception flow to, add a new business process to the defect prevention diagram. Also, find the input that will be the output destination of the added business process, and add a flow relationship to the corresponding business process.

[Step 5] Check that the created defect prevention diagram is appropriate from the following perspectives.

- There are no missing business processes
- There are no missing inputs and outputs
- There are no missing conditions
- There are no missing exceptions
- There are no missing flow relationships

[Step 6] If there are any missing conditions in step 5, repeat the corresponding step. Otherwise, end.

(End of procedure)

Business relationship analysis

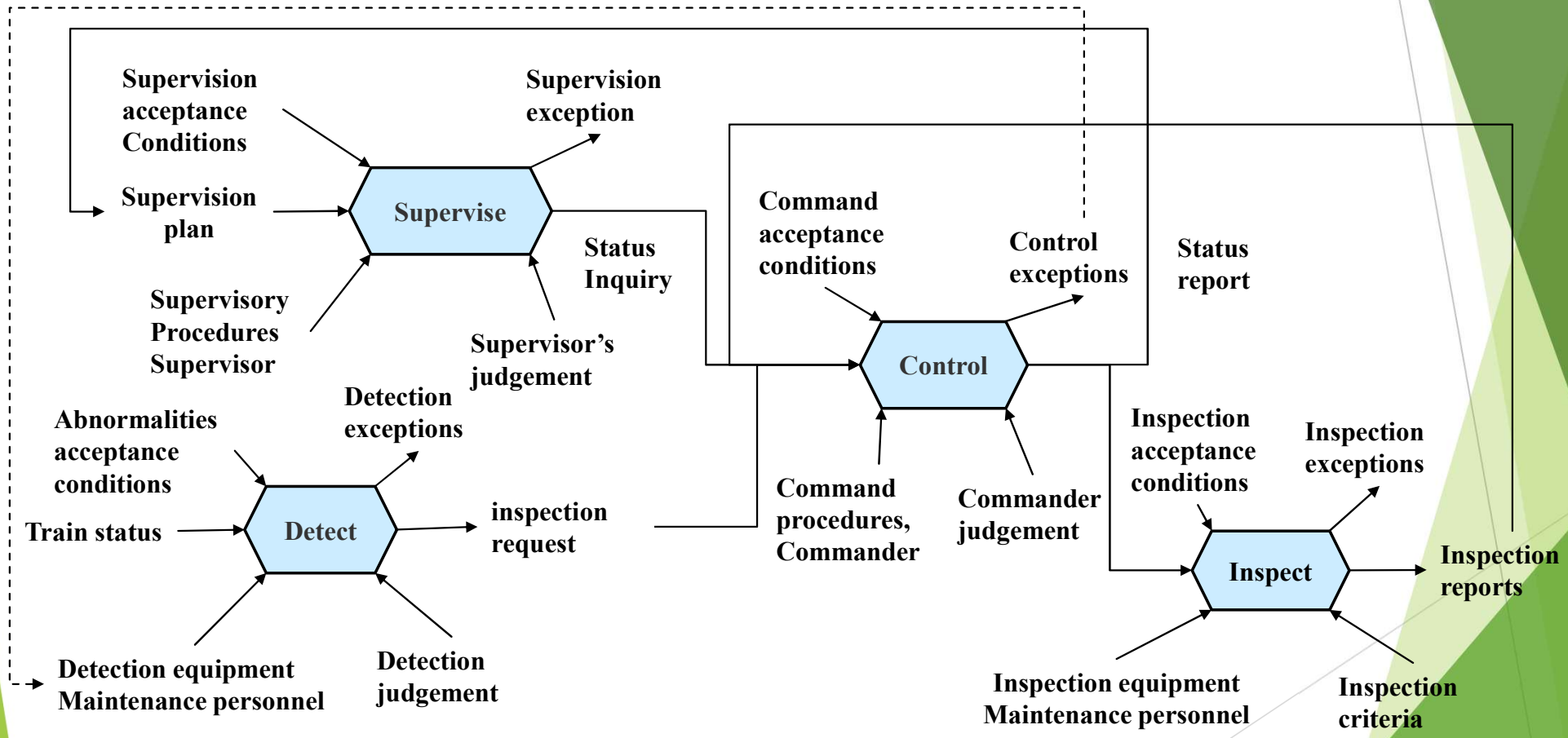
- The business process relationship matrix can be used to comprehensively check the connection flow between business processes that make up the defect prevention diagram.
- For example, the transitive closure of the business process relationship matrix can define a set of connection relationships for business processes.
- The set of connection relationships for X in Table I is $\Sigma_{k=1,\,n}\,(R_{xy} \bullet R_{yx})^{k}$. R_{xy} is the relationship from X to S: Y, and R_{yx} is the relationship from Y to T:X.

Process Relationship Matrix

	X	**Y**
X	Goal of X	X to S:Y Relationship
Y	Y to T: X Relationship	Goal of Y

S and T are either the receiving condition A, the resource condition R, or the judgment condition J. If S and T are omitted, they are taken to be the relationship to the input of the target process.

1. Train Operation Management Process



PROCESS RELATIONSHIP MATRIX FOR TRAIN MANAGEMENT

	Supervise	Control	Detect	Inspect
Supervise	Governance	Status inquiry		
Control	Status report	Command and Control		Inspection instructions
Detect		Inspection request	Check for abnormalities	
Inspect		Inspection report		Inspection

Discussion -- Novelty

L1	Business process knowledge
L2	Business flow-related knowledge
L3	Business action condition knowledge
L4	Business action execution knowledge

▶ In the business process knowledge of a defect prevention diagram, L1 can grasp the overall picture of the business process by identifying the necessary actions that make up the business process.

▶Business flow-related knowledge L2 can recognize the dependencies between business processes.

▶Business process action condition knowledge L3 can recognize what conditions are necessary to execute the business.

▶The difference between L3 and L4 is the difference between knowing the conditions and being able to appropriately confirm and evaluate those conditions.

▶In the defect prevention diagram, this type of business process knowledge classification is used to organize business knowledge that has traditionally been thought to vary between individuals, making it possible to clarify where the variations in knowledge are occurring.

Discussion – Applicability & Limitations

- In this paper, we confirmed the applicability of the proposed method by applying it to train operation monitoring operations. Because this case is an important business process in fields other than operation monitoring operations, the proposed method may be applicable to a wider range of applicable business processes.
- In this paper, we proposed a method for reviewing defect prevention diagrams. However, we have only applied it to one case study. In the future, we need to quantitatively evaluate the effectiveness of the method by applying it to many cases.

Conclusion and Future work

- A procedure for creating a defect prevention diagram and a review method had proposed for describing business processes in industry.
- The process relationship matrix can analyze the comprehensive dependencies between the business processes that constitute the defect prevention diagram.
- The completeness of the defect prevention diagram is formulated by its ability to respond to exceptions.
- However, we have not yet discussed whether such an exception response is sufficient. Therefore, we plan to continue to consider the completeness of the defect prevention diagram. Moreover, more case studies and technical details shall be provided as future work.