# **Situated Action in Project Management**

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#### Abstract

This research attempts to bring the viewpoint of "situated action" into product development theory. By taking the approach of regarding the management action of project leaders during development not as "action based on plan" but as "situated action," it will be able to explain the phenomenon of the changing pattern of the process model (time design of development process) of product development projects not as "the process of selection" but as "the process of evolution."

The premise of most of the previous research on product development was that the project leader, to make the decision of the process model of product development project, chooses the best process model after a comparative review of the conformity between the content of the multiple process models and environment. Under this premise, it was valid to apply the logic of selection in order to explain the birth and the history of the change of the dominant process model. There exists a tacit understanding behind the idea that the effectiveness of the process model is evaluated and selected by the conformity to environmental conditions. The tacit understanding is that the project leader executes the management action of the project, following an action plan originating from the process model ("action based on plan.") However, this tacit understanding was discredited by the findings from the field research of a software development company. It can be interpreted that many project leaders extracted the next management action is called "situated action." The findings of the results show that the management action of the project. Thus, as the basis of the theory of selection became fragile, I saw fit to inquire into the process of the birth and the change of the dominant process model from a new perspective.

In software project development, "the waterfall model," which is characterized with its single cycle and sequentiality of its developmental stages, was dominant. Today, however, it is no longer the dominant model. Hence, I conducted research interviews with 24 project leaders at company A, a Japanese software developer, where the "the waterfall model" is losing its dominance. From their comparison of their experience of the projects based on "waterfall model" and other models, "the anti-waterfall model," I got several findings.

As a result of discussion and consideration through these findings, I think that the phenomenon that the WF model is losing its dominance is not due to the replacement of the WF model by the other model, but is the appearance of the change of the WF model itself so that it could allow improvisational management. As has discussed previously, the change of dominant process model can be explained not by the logic of selection but by the logic of evolution.

### 1. Introduction

In product development research up to this date, various organizational factors have been analyzed which influence the success of product development project. Most of those studies were "individual project research" which put the unit of analysis on each individual project. By contrast, recently "multi projects research" has appeared which focuses on organizational activities that are originated among manifold projects. Most of the individual project research views product development as an "independent unique problem solving process." On the contrary, multi project researchers share the view that product development is the "knots of continuous organizational learning activities<sup>1</sup>)."

Individual project research is segmented into three fields, such as "organizational design", "group process and

communication," and "engineering process<sup>2</sup>)." I focus on "engineering process." In this field they pay attention to the influences of time design of development process on the development lead-time. The main topic discussed was the comparison<sup>3) 4</sup>) of "sequential process vs. overlapping process" originated by the arguments of overlap<sup>5) 6</sup>) and the comparison of "emphasis of initial plan vs. trial and error repetition<sup>7) 8</sup>)." The former focuses on the dimension of "stage overlap" which captures the development process design from the viewpoint of "whether there are overlaps in development process or not." And the latter emphasizes the dimension of "cycle iteration" which investigates "whether development process put emphasis on initial plan and make only one cycle of development from upper stream to lower stream, or put emphasis on learning by experience and repeat the cycles time and again."

Although the dimension focused is different, previous research related to this issue seems to have shared the style of discussion which models the design of development process and argues the relative merits of the models. In this study we call the modeled design of development process "the process model."

Most of the previous research related to the process model have stood on the framework of contingency theory (theory of organizational adaptation to environment.) The organizational characteristics listed by contingency theory were organization structure, management system, organization pattern, and organization process. And they have investigated what is the relationship between these characteristics and environmental characteristics to maximize organization output. Even the research on contingency theory, which asserts there is no all-purpose cure method applied to any environments, has progressed with the basic presupposition that there is "the best organizational condition" under certain conditions. As the process model of development projects is also regarded as on organizational process, the studies of the process model have made progress under the premise of "the best process model" under certain conditions.

When we look inside the individual project, the research has assumed a decision making of process model in which the project leader selects the best process model by comparing and considering the conformity of the content of multiple process models and environmental conditions. Under such an assumption, it was valid to apply the logic of selection in order to explain the birth and the change of the dominant process model. This logic of explanation is that new process models of product development are constructed and proposed by the practitioners/observers, and the process model, which fits the environmental condition most, becomes dominant and the other process models will be weeded out as the result of being tested in place.

There exists a tacit understanding behind the idea that the effectiveness of the process model is evaluated and selected by the conformity to the environmental condition. The tacit understanding is that the project leader executes the management action of the project, following the action plan derived from the process model ("plan-based action.") It is because the process model needs to be actualized for its effectiveness to be evaluated.

However, this tacit understanding and the findings from field research on a software development company are mismatched. It can be interpreted that many project leaders extracted the next management action impromptu by confronting the accidental and unpredictable events that happen continuously. For example, one project leader distributed a product prototype with the purpose of examining the variety of customer assets and the unpredicted operating procedure. There he found that the responses about the prototype sent via email raised the members' morale and so he utilized them for motivation management. Such an action is what is called "situated action<sup>9</sup>)" that is taken in the context of a particular, specific situation. The findings from the examination show that the management action of the project leader is not only conducted according to the action plan set at the beginning of the project. Thus, as the basis of the theory of selection became fragile, I saw fit to inquire into the process of the birth and the change of the dominant process model from a new perspective.

### 2. Conceptual Framework

#### 2.1 Overall

The framework of this study is based on the assumption that the management of the project leader is "situated action" and the process model employed at the beginning is not always actualized in its entirety. "Situated action" is a concept that regards human action as something that corresponds impromptu to the environment of the site and its change. The possibility of the next action will become clear when he/she is interacting with environment while taking certain action and it cannot be predicted beforehand. Hence, the ready set "plan" does not constrain sequential actions men take, but the plan created impromptu only directs the situated action of men as a "resource." This is the way in which researchers of situation theory think. The framework of this study cuts across the cognitive process of the leader and action process within the group and consists of 5 factors – "model a prior, " "model a posterior," "group process," "management," "recognition of environment." (Fig.1)



Cognitive Process of the Leader (Reflection)

Fig. 1 The Conceptual Framework

In this framework the decision-making mechanism of process model within the individual project is assumed as follows: First of all, at the beginning of the project, the project leader recognize the surrounding environment, and draws up the design of development process in his/her mind. Next, the project leader conducts the management action so that the ideal group process actualizes. But the process model is not mapped entirely to reality and group process generates unintended situations. The project leader takes the generated group process as back-talk from the situation and reflects on it, and modifies the process model. I assume in this study that such a project leader is a "reflective practitioner<sup>10</sup>." Strategy (model a prior) influences the group process (group process and management) and the group process, which occurs in the process, influences back again the strategy (model a prior) through reflection (model a posterior.) This loop can be spiraled not only in an ongoing individual project, but also over multiple projects depending on the will of the project leader. I will proceed to add explanation to the 5 factors that make up the framework and the influence between them.

### 2.2 "Model a Prior" and "Model a Posterior"

This study defines "the process model" as "the project leader's concept of development process design." This concept is expressed in the form of development plan or Gantt chart and transferred to the project members orally. It is called "model a prior" when it is used as the strategy and concept to direct the development process. When the concept is used to understand and reflect the already realized development process a postmortem, it is called "model a posterior." The project leader is the pillar of the projects management, who actually conduct the progress check, production control affairs such as quality control, disposition of engineers, overwork management, technical support to project members, and on occasion personal administration such as management of dispatched engineers. Model a prior is the basic guideline for the project leader to manage the process of the project. The project leader who conducts management action with the guideline of model a prior creates a new process model by reflecting the development process that actually he/she followed (is following.)

### 2.3 "Group Process"

Group process, in general, can be divided into two: interaction beyond group domain and interaction within group domain. The group process in this framework focuses upon the latter interaction, interaction within group domain, and calls it "internal interaction". In order to capture the internal interaction, three cut edges of "division of labor," "coordination," and "learning" are effective. I assume these three factors are influencing each other. Model a prior can be considered to limit the way of division of labor and coordination by being expressed as development plan and Gantt chart primarily at the beginning of the project and influence the way of coordination by letting project members recall the experience of past projects. By the way, the software development project team, the subject of this study, normally consists of 10 project members or so and is a group in which members interact daily.

#### 2.4 "Management"

"Management" action, which I deal with in this study, is defined as "action which the project leader takes with the intention to intervene in internal interaction." This management action can be basically assumed to have high consistency with model a prior. However, there is no specific reason to believe that model a prior rigorously constrains management action since the project leader is not always conscious of model a prior while conducting management action. And even though the project leader conducts management action perfectly following model a prior, the project leader, who is an actor him/herself, cannot judge or decide the social (collective) meaning of the action. Cognitive science has shown that meaning of language or action cannot be resolve to the person in speech or in action. This is the reason to distinguish between model a prior, the cognitive process of project leader, and management, the process of action.

#### 2.5 "Recognition of Environment"

The last factor to be explained is "recognition of environment" of the project leader. Environment in this context indicates such conditions as technology environment, market environment, and group size, which encompass the development process. "Recognition of environment" is the cognition of the project leader as to these conditions. Recognition of environment is never passive and there is a perspective that environment "enacts" by a cognitive subject's working in the external world<sup>11</sup>. Although I basically agree with this perspective, I set recognition of environment as exogenous variable in order to simplify the framework and narrow the focus of analysis.

#### 3. Research Method

The subject of this research, company A, is a Japanese software development company. I found a clue for the research of process model in software product development from the comparison between "the WF model" and "the anti-WF model." "the WF model" perceives the development process as a continuation of successive process flow, and its prominent characteristic is its sequential stages as the water flows from upstream to downstream (Fig. 2.)



Fig. 2 The Waterfall Model of the Software Development

This WF model was dominant in product development in 1970's. However, since the mid-1980's, "the evolution model<sup>12</sup>)" and "the spiral model<sup>13</sup>)" have been proposed, replacing the WF model. While the software company ten years ago followed the WF model in most of its software product development projects, in these few years several process models other than the WF model coexist with the WF model within the company. Therefore, I set up an interview with those project leaders who have the experience of project management following both the WF model and the process model other than the WF model (the anti-WF model.)

I made up the interview items from the preliminary study in company A from October 1996 to March 1999, and conducted a case study that mainly consisted of face-to-face interviews between July and November 1999. The face-to-face interview was carried out over 2 weeks, the weeks between July 5<sup>th</sup> and 9<sup>th</sup>, July 26<sup>th</sup> and 30<sup>th</sup>, 1999. Each week, 12 intensive interviews were conducted. The average time of one interview was about 100 minutes. After that, interviewee had question and answer via e-mail if needed and confirmation of the facts.

The subjects of the interviews were 24 veteran project leaders selected by a particular procedure. The interview took the style of a one-to-one talk between the interviewee (the project leader) and the interviewer (the author.) Most of the project leaders offered reference materials such as the brochure of the product from each project, manual, Gantt chart, function specification and so on. In addition, some of the project leaders offered weekly reports and private daily reports to the author. (MD recorded the content of the dialogue given the permission of the interviewees.) And the whiteboard in the interview is used to record digital graphics file and utilized as the reference material for analysis

together with the product introduction website.

Interviews were conducted in accordance with the interview items. However, the order of questions or the depth of each question was changed by interviewer (the author) by observing the responses of the interviewees or the condition/atmosphere of the interview. In other words, the method of interview was half-structured interview based on a prior format.

## 4. Findings

#### 4.1 The Reason for Adopting the anti-WF Model

This chapter introduces the main findings as a result of the research. The first finding is the reason for adopting the anti-WF model. In the interview, I directly interviewed the interviewees as to the reason why they had followed the anti-WF model. What was common among the responses was "uncertainty," though each interviewee responded in a slightly different way. Let me list some of them up: uncertainty of the place where problem occurred, uncertainty of related products, uncertainty of customer needs, uncertainty of customer behavior, uncertainty of new technology, uncertainty of standard, uncertainty of performance of core function. The recognition of such various uncertainties may lead the project leader to adopt the anti-WF model instead of the WF model.

#### 4.2 Ways to Cope with Uncertainty

It was primarily the recognition by the project leader of high uncertainty that resulted into the adoption of the anti-WF model. Therefore, does the anti-WF model have certain characteristic that enables it to handle uncertainty in an effective manner? For example, if we define uncertainty as "the gap between the amount of information resource to execute a task and the amount of the information that the organization already possesses<sup>14</sup>," does the anti-WF model reduce the burden of information processing or does it amplify the information processing capability of the organization? Simply guessing, it is possible to anticipate that the project leader adopts the anti-WF model as it has such a characteristic. However, the research result showed a totally opposite implication. As the anti-WF model project places a high value on learning through experience and repeats the cycle again and again, the timing of fixing the final specification is delayed and the problems have more complexity.

"Problems become more and more clear as the process goes on in the WF model. However, in this (the anti-WF model), the problems become more and more complex as the process goes on." (Project leader A)

As is found in the quotation above, the anti-WF model has the characteristic to amplify the burden of information processing instead of reducing it. And the characteristic to amplify the information processing capacity that covers the increase of burden could not be found from this research. Gathering up the threads, the anti-WF model itself may not be installed the program to cope with uncertainty in a better way.

### 4.3 The Comparison of Group Process

The comparison of the group process (internal interaction) of the project based on the WF model and the group process of the project based on the anti-WF model suggests that the anti-WF model project has more freedom to be performed in a more improvisational way. This can be summed up with "division of labor," "coordination," "learning," with representative quotation.

#### (1) Division of Labor

The project based on the anti-WF model delegated more responsibility and authority to individual project members. "I left the source review to each developer and basically didn't concern myself with the design or coding except when I handled and inspected it in the event of an emergency"; "I could not the use the anti-WF model if I could not trust those in charge" (Project leader B)

### (2) Coordination

In the project based on the anti-WF model, coordination for problem solving was done more immediately. Problems are not left on pending status.

"We daily had dialogue among the members and between the members and the leader and we coordinated at the point when addition or change of the function generated"; "We had regular meetings twice a month. Moreover, I

tried to promote occasional meetings by arranging the workplace layout. The members could start discussion just turn their head back" (Project leader C)

## (3) Learning

In the project based on the anti-WF model, learning during the progress of a project was apt to happen more, and the learning mostly attended an unexpected discovery.

"In the demonstration of the first prototype (which was conducted at the customer, a metal mold design company,) there arose feedback which no one had expected. It was "to divide in twice when boring a big hole" (Project leader D)

### 5. Discussion

#### 5.1 The Appearance of Situated Action

Putting the findings of research together, the anti-WF model itself is not installed in the program to cope with uncertainty in a good way, but it suits projects facing high uncertainty as it allows the improvisational action of the project leader and members. Namely, while the WF model itself is a "tight" model a prior which requires the project to be followed, the anti-WF model is a "loose" model a prior.

Management action of the project leader in the anti-WF model supports this perspective. The project leaders managed in a more improvised way in the anti-WF project than in the WF project. At the mid-stage of the WF project, they focused on formulaic, designed, and periodical management such as checking progress and reviewing output. On the other hand, the anti-WF project had a strong tendency to be un-programmed and improvisational; for example, "maintenance of partnership within the group/team", "immediate judgment of the problem emerged and attainment of the straightway handling", "concentration of efforts on building functional party which was the bottleneck of development."

It is nearly impossible to standardize (program) such an un-programmed and improvisational management. The proceeding action cannot be found until we put ourselves into the situation. For example, group partnership cannot be maintained unless you observe the members deeply and immediately handle the events occurring by accident.

#### 5.2 The Conditions for the Appearance of Situated Action

Improvisational management, in other words, the smooth appearance of situated action needs the devises for the project leader and the members to grasp the context of the situation. There were many cases in anti-WF projects that the project leader also was in charge of a specific functional module and conducted coding. Engaging in not only work operation in his/her head such as plan or design but also in work operation actually using hands such as coding has an effect to put oneself into the situation and receive the direct response from the situation.

The configuration of seats which many project leaders oriented can be regarded as a device to capture the context of the situation. The configuration of seats which I named "Rim-style" is a configuration that development members including the project leader are seated back-to-back (Fig. 3.) The original "Island-style" can capture the situation better than a style that allocates each project member a private room. However, in this "Rim-style," the project leader comes much closer to the members and can bring the displays of members into view. We can assume that the aim of this configuration is not to check and control the members strictly since the anti-WF project is already well advanced in delegation of power. Rather, the aim may be to perceive the change of a situation immediately. This is especially effective in capturing the context of the situation in the kind of occupation like software development, where people work facing a display.



Fig. 3 Rim-style Office Arrangement

### 5.3 From the "Logic of Selection" to the "Logic of Evolution"

By introducing the perspective that the essence of the project leader is situated action, it will be possible to explain the change of dominant process model not by "process of selection" but by "process of evolution."

Here we confirm the "logic of selection." The project leader selects one process model out of multiple process models that might fit the environment, and conducts management action following the action plan which was introduced from the selected process model. As a result, the process model that conforms well to the environment leads the project to success and fixes its dominant position. On the other hand, the process model which does not fit the environment leads the project to failure and will not be considered. Using this logic of explanation, we can explain the phenomenon of the WF model losing its dominant position in software development as follows: "the WF model was a model that fitted an environment of low uncertainty. However, as the uncertainty increased, the WF model was taken its place by the anti-WF model which conformed to the environment with high uncertainty." However, I propose in this study the "logic of evolution." The project leader, though using the dominant process model as a guideline, modifies the process model in order to keep the freedom to manage in the way of situated action. Although the points of the modification differ among the project leaders, they share such a modification that they weaken the influence of the process model on action. With this logic of evolution, the phenomenon of the WF model losing its dominant position can be explained as follows: "As the uncertainty of the environment increased, the project leader came to recognize the importance of improvisational management strongly. Hence he/she started to deal with the process model not as a program which constrains the action strictly as they have done but as one of the resource that influence action. Therefore, the anti-WF model is a evolved form of the WF model."

### 5.4 Engine for Change

Under the logic of selection, the project leader who recognized the increase of uncertainty of the environment deviate from the WF model, in order to use the other process model that replaces the WF model which became less compatible to the environment. In that case, the engine for change is the "gap between the environment and the process model" which derives from the change of the environment.

On the other hand, under the logic of evolution, the project leader who recognized the increase of uncertainty of the environment modifies the WF model in order to set the conditions for the appearance of his/her own situated action. In this case, the engine for change can be found in the "conflict between the process model (model a prior) and the action." Logic of selection assumes the process model and action match each other and without any gap between them. However, the logic of evolution does not consider that the plan drawn from process model matches the actual action.

Here I would like to illuminate the concept of the "gap between model a prior and action," which is the engine of the change of dominant model under the logic of evolution. The inhibition of situated action by the WF model was the engine for change of the dominant model in software development. Hence I propose the concept of "binding power of

model a prior." "The binding power of model a prior is strong" means that model a prior is taken as the formation of American football and it constrains the action of the leader and the members strongly in the development process. The actual game is surely held by the players' executing the formation. The action there is generated and controlled by the model. On the other hand, if we say the binding power of the model is weak, it means that the model a prior is treated like the formation of rugby or soccer and the situated action in development process is allowed and admitted. Although the players share the formation, improvisational change in accordance with situation is added and such a change induces the next change. The model comes out later as a result of action.

Observing that more situated actions appear in the anti-WF model than in the WF model, I consider that the WF model is a model with strong binding power and the anti-WF model is a model with weak binding power. In the case of software development, the project leader revised the WF model so that the binding power of the model a prior decreases.

### 6. Conclusion

What this research showed is that the change of dominant process model can be explained by bringing the viewpoint of situated action into product development theory. This study, with the theme of project management in software product development, reached the result below.

In the research field of software engineering, many "new process models" that will replace the WF model have been proposed. And such terms as "prototype development" and "spiral model" are used under the influence of those proposals. Therefore, we tend to see the reality as if entirely new models have emerged and those models are struggling for existence. However, this research showed a different explanation by introducing the viewpoint of situated action (Table 1.) Other models are not replacing the WF model. The WF model is evolving through the reflection of the project leader. This is the explanation for the reduction of the WF model's dominance.

	Conventional Perspective	New Perspective in this research
Action of the Leader	Plan-based Action	Situated Action
Logic of Dominant Model	Selection	Evolution
Engine for Change	Conformity between the Model and the Environment	Binding Power of Model a Prior

### Table 1 Contrast between Two Viewpoints

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