

# 프로젝트 경험이 프로젝트 성과에 미치는 영향

## Project Experience and its Impact on Project Performance

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### 요약

탐색은 도전적인 업무 환경을 제공하지만, 높은 수준의 복잡성과 모호성을 동시에 제공한다. 그에 반해, 활용은 덜 도전적인 업무 환경을 제공하며, 낮은 수준의 복잡성과 모호성을 제공한다. 이러한 두 활동의 특성을 고려해 보면, 두 가지 활동을 동시에 프로젝트 매니저들에게 할당하는 것은 가장 좋은 프로젝트 작업 환경을 제공한다고 볼 수 있다. 168명의 프로젝트 매니저들의 프로젝트 데이터를 바탕으로 로짓 회귀 분석을 통해 가설을 검증한 결과 활용 프로젝트 경험이 있는 매니저들은 활용 프로젝트에서 높은 성과를 보였고, 활용과 탐색 프로젝트 경험이 있는 매니저들은 프로젝트의 종류에 관계없이 높은 프로젝트 성과를 보이는 것으로 나타났다.

■ 중심어 : | 활용과 탐색 | R&D 매니지먼트 | 프로젝트 성과 |

### Abstract

The assignment of exploration on individuals provides challenging work environments, while it generates high levels of complexity. On the other hand, the assignment of exploitation on individuals offers less challenging work environments, while it makes low levels of complexity. Give the characteristics of exploration and exploitation, I argue that the assignments of both exploration and exploitation create the favorable work environments to individuals. Developed hypotheses were tested using a logit regression from a sample of 168 project managers in a R&D center. I found that a manager who experienced exploitation project(s) is positively related to higher performance in exploitation project(s). In addition, a manager who experienced both exploitation and exploration projects are found to be positively associated with higher project performance.

■ keyword : | Exploration and Exploitation | R&D Management | Project Performance |

## I. Introduction

It has long been thought that an organization's ability to exploit its current capabilities and to explore new ones simultaneously enables that organizations'

sustainability[1][2]. March's[2] definitions of exploitation and exploration were proposed in terms of learning activities to enhance an organization's competitive advantage. Although Levinthal and March[1] limited the definitions of exploration and

exploitation to organizational learning, subsequent studies expanded the scope of exploration and exploitation to include organizational adaptation[3-5], strategic management[6], organizational design[7] and technological innovation[8].

Exploration and exploitation may be differently interpreted by the actors in different hierarchical levels. At the strategic level, top managers perceive exploration as risky and uncertain and exploitation as less risky and certain. The two activities are also seen as different tasks at the operational level. Exploration can be perceived as a challenging task that provides the opportunity to learn and to be motivated. On the other hand, exploitation can be interpreted as a less-challenging task that is also a less-risky and more certain task.

Given the differences in both challenge and risk, it seems likely that the way the activities (exploration, exploitation, or both) are assigned to individuals may influence their motivation, attitude, and learning experience. In turn, these differences in motivation, attitude, and learning likely lead to different individual outcomes or project outcomes[9]. I argued that the three types of work assignments have different effects on project performance due to the different work experience they entail.

This study contributes to the current exploration and exploitation literature by two folds. First, this study expanded the scope of exploration and exploitation. While exploration and exploitation have been studied at the organization level, this study reveals that exploration and exploitation are related to individual motivation and work environments. Second, this study also contributes to R&D management, suggesting that managers assigned to both exploration and exploitation projects are more likely to perform better. This provides how projects need to be assigned to managers. In the following

section, I will investigate the relationship between the three types of work assignments to managers and managers' project performance.

## II. Theoretical Background

### 2.1 Project performance as the Outcome of Three Types of Work Assignments

Project performance is defined as the extent to which a project can meet established quality, cost and schedule goals[10]. The quality of project performance refers to obedience to defined qualitative properties of the product, service, or process to be developed. The cost and schedules represent the project's efficiency. The evaluation of cost and schedules is based on a comparison between actual versus allocated input[10]. The critical success factor for project performance is the adherence to quality, cost, and schedule goals for a project, which highly depends on the skills and knowledge of project managers and members about the project.

The mechanism to explain the relationship between three types of work assignments and project performance is similar with that for individual performance such that different work experience from three types of work assignments leads to different project performance through the development of skills and knowledge and the different level of motivation[9]. However, two factors should be considered in order to investigate the effect of work assignments on project performance.

First, the effect of work assignments on project performance varies by two types of project due to the contrasting characteristics of exploration and exploitation. For example, an exploitation project is a project whose technology or target customers are already known to a focal firm[11]. Thus, skills and

knowledge which managers learned in previous exploitation work assignments are directly linked with those in new exploitation work assignments. On the other hand, an exploration project is a project whose technology or target customer is new to a focal firm[11]. Project managers or members are not familiar with the skills and knowledge necessary for new exploration projects regardless of their previous project experience. The fit between previous and future work assignments provides project managers with opportunity to utilize their experience. Project managers who have exploitation work assignments can take advantage of skills and knowledge in the following exploitation project. Thus, it leads to the following hypothesis:

H1: Managers with exploitation work experience (specialist) achieve higher project performance on subsequent exploitation projects than managers who have exploration work assignments

Second, the assignment of projects to a project manager determines the type of individual learning. For example, the assignment of an exploitation project makes manager who experience an exploitation project a specialist, whereas the assignment of an exploration project makes manager a generalist. According to Kang and Snell[12], individuals are categorized either specialist or generalist in terms of learning experience. Specialists hold knowledge which is “deeper, localized, embedded, and invested within particular knowledge domain (p. 68)”, whereas generalists are “multi-skilled with a more versatile repertoire of capabilities that can be used across alternative situation (p. 68)”. The implication of the two types of individual learning is that various knowledge of multiple domains versus

deep knowledge in a particular domain generates different effects on not only their current knowledge but also their knowledge searching behavior or mind-sets[13].

Specialists are more likely to acquire new and deep knowledge within specific domain[14]. However, they intend to have a ‘functional bias’ that prevent them from exchanging ideas with their colleagues and linking new knowledge beyond their particular domain[15]. In addition, they think that their exploitation work assignments limit opportunity to make advantage of their full knowledge, skills and ability and be exposed to challenge. Thus, the assignments of exploitation work to managers who have exploitation work assignments makes project managers to be demotivated.

On the other hand, generalists are less likely to be engrained in a ‘functional bias’ and are willing to be exposed to knowledge in diverse domains[12]. Generalists also have capability to interpret problems and situations with varied perspective through flexible mental models[16]. Generalists are spontaneously exposed to work environment which provide a high level of task variety. According to the job characteristics model, skill variety, task identity and task significance enhance the improvement of the meaningfulness of work. In turn, it finally lead to better individual outcomes such as motivation, individual performance, individual job satisfaction, and low turnover[17]. Therefore, I suggest the following hypothesis:

H2: Managers with exploration work experience (generalist) achieve higher project performance on subsequent projects than managers who have other types of work assignments

Managers assigned to ambidextrous work hold a

Table 1. Means, Standard Deviations, and Correlations

No	Variable	Mean	St. dev.	1	2	3	4	5	6	7	8	9	11	12	13
1	Ambidextrous work assignment (t)	0.29	0.45												
2	Exploration work assignment (t)	0.23	0.42	-0.3*											
3	Exploitation work assignment (t)	0.48	0.44	0.21*	0.04										
4	Age	40.4	3.67	-0.1*	-0.08	-0.1*									
5	Tenure	11.2	5.52	-0.1	-0.16*	-0.11	0.7*								
6	Education ==Bachelor	0.05	0.22	0.0	0.03	-0.01	0.07	-0.01							
7	Education ==Doctor	0.22	0.42	-0.15	0.29*	-0.1*	0.05	-0.2*	-0.1*						
8	Education ==Master	0.73	0.45	0.14*	-0.29*	0.14*	-0.1	0.2*	-0.4*	-0.9*					
9	Individual competency	6.03	0.36	0.28*	-0.06	0.33*	-0.2	-0.2*	-0.09	-0.1	0.1*				
10	Project performance (t+1)	3.43	0.95	0.18*	-0.11	-0.01	-0.1	-0.09	-0.09	0.03	0.02	0.1			
11	Exploitation project performance (t+1)	3.33	0.95	-0.01	-0.13	-0.14	-0.1	-0.08	-0.12	0.08	-0.1	0.22*	0.85*		
12	Position ==Manager	0.47	0.50	0.13*	0.05	0.09	-0.5	-0.3*	-0.04	-0.04	0.06	0.14*	0.14*	0.11	
13	Position ==Senior manager	0.53	0.50	-0.1*	-0.05	-0.09	0.49	0.34*	0.04	0.04	-0.1	-0.1*	-0.1*	-0.1	0.1

mixture of characteristics of both a specialist and a generalist. A previous ambidextrous work assignments enables project managers to have a chance to experience diverse skills and knowledge of both exploration and exploitation projects. While managers who have ambidextrous work assignments utilize skills and knowledge that they already know in an exploitation project, they also deal with new skills and knowledge in an exploration project. While they are more likely to have the opportunity and motivation to learn by handling new skills and knowledge compared with managers who have exploitation work assignments. (they are more likely to be demotivated) On the other hand, they have advantages over managers who have exploration work assignment. Ambidextrous work assignment enable managers to use skills and knowledge learned from a previous exploitation project, while keep them to be motivated.

In addition, a continuous involvement in exploration can force managers to be exposed to high level of job complexity, which is one aspect of exploration.

Complexity is defined as a lack of knowledge that suggests clear guidelines for meeting requirements and the degree of ambiguity about actions and alternatives to meet requirements for a task[18]. Job complexity has a negative effect on task performance[19]. Therefore, managers who had only exploration project are prone to be burned out due to the high level of complexity. However, ambidextrous work assignments provide managers with a buffer for job complexity, and in turn lead to higher project performance.

In sum, managers who have ambidextrous work assignments have an advantage over managers who have exploitation work assignments in terms of the opportunity to develop new capabilities, skills, and knowledge. At the same time, they have an advantage over managers who have exploration work assignments in terms of knowledge and skills available to an exploitation project. In addition, ambidextrous work assignments also offer a buffer for a high level of job complexity, one of aspect of exploration. Therefore, I suggest the following

competing hypothesis against hypothesis 2:

H3: Managers with ambidextrous work experience (a mixture of a generalist and a specialist) achieve higher project performance on subsequent projects than managers who have other types of work assignments

### 3. Methods

The research setting for this study provides a good opportunity to investigate exploration and exploitation at the operational level because this R&D center has projects information (e.g., project type) and managers' information (e.g., individual performance and demography data). For the analysis of the relationship between work assignments and project performance, the given information of projects and managers offer variables to influence project performance such as individual competency, tenure in this firm, and position. These variables help minimize heterogeneity of managers' performance.

The following descriptive statistics are for the 168 managers who were observed for four years (2009 - 2012). The average tenure of these managers was about 9 years in 2009 and the average age was 38 years old in 2009. Senior managers made up 29% (49) and managers accounted for 71% (119) of 168 managers in 2009. 123 (73%) managers of the 168 have a master's degree, 8 (5%) managers have a bachelor's degree, and 37 (22%) hold a Ph.D. degree[Table 2].

**Table 2. Demographic summary of managers as of 2009**

	Tenure (years)	Age (years)	Senior position	Education
Average	9	38	49	Ph.D: 37 Master :123

### Measures

#### Dependent variables

The dependent variable for investigating the effect of the three types of work assignments on project outcomes is project performance. For hypothesis 1, exploitation project performance is used. The evaluations of projects were made based on the accomplishment of project milestones. When a project starts, the project manager is required to submit the milestones of the project. At the end of the year, a direct supervisor evaluates the project. Exploration and exploitation projects were evaluated separately. The relative evaluations of exploration and exploitation projects were made every year. Projects were evaluated using a 5-point scale in which five represents the highest performance and one means the lowest. The project managers were evaluated based on other key performance indexes such as the development of project members and activities for innovation as well as on the performance of project(s). Project performance evaluations were done using a 5-point scale (1, lowest - 5, highest). There is no difference among the means of project performance evaluations for four years ( $F=0.51$ ,  $p=0.67$ )

#### Independent variables

Independent variable is the three types of work assignments which I suggest have different effects on project performance. Three work assignments are 1) ambidextrous work assignments 2) exploration work assignments and 3) exploitation work assignments. When both exploration and exploitation projects were assigned to a project manager, it is defined as ambidextrous work assignments. When only exploration projects were assigned to a project manager, it is defined as exploration work assignments. When only exploitation projects were

Table 3. Results of logistic regression of project performance (exploitation): Cluster-manager

DV: Exploitation project performance (t+1)		
Model 1		
Measure	$\beta$	s.e.
Individual competency (t)	0.702*	(0.305)
Age (t)	-0.040	(0.042)
Tenure (t)	0.007	(0.026)
Education 1 (Bachelor)	0.049	(0.372)
Education 2 (PhD)	0.403	(0.306)
Position==Manager (t)	0.025	(0.243)
<b>Ambidextrous work assignment (t)</b>	<b>0.205</b>	<b>(0.304)</b>
<b>Exploitation work assignment (t)</b>	<b>0.495*</b>	<b>(0.284)</b>
Cut-off 1	1.256	(2.725)
Cut-off 2	2.177	(2.726)
Cut-off 3	3.460	(2.725)
Cut-off 4	4.548	(2.750)
N	123*	
Chi-square	13.41	
df	8	
-2 log likelihood	-131.65	
pseudo R2	0.04	

$p^* < 0.05$ ,  $p^{**} < 0.01$ ,  $p^{***} < 0.001$ .

; two-tailed tests

\* Only exploitation projects were considered

offered to a project manager, it is defined as exploitation work assignments.

The assignment of ambidextrous work occupies 29% (195) out of 672 manager-year observations. The quota of ambidextrous work assignments ranges from 24% to 35% by year. The assignment of exploration work occupies 23% (155) and that of exploitation work accounts for 48% (323).

To exclude the possibility that ambidextrous work in a certain year was given to a manager who had achieved a high performance evaluation in the previous year, the assignment of ambidextrous work was regressed against managers' performance in the previous year. The result displays that there is no significant association between the assignment of ambidextrous work and managers' performance.

#### Control variables

Age: Age may impact the work assignment because old managers are likely to have superior

capabilities and more knowledge from their experience. This variable is lagged by one year.

Tenure: I generated the variable tenure measured as the number of years a manager has worked in the firm.

Education: Two education variables were created. The value of one was given to education 1 dummy variable if a manager holds a bachelor degree. The value of one was given to education 2 dummy variable if a manager holds a Ph.D degree. A manager who has a master degree is the reference.

Position: To control for tiered level effects, I generated the dummy variable position. Position takes the value of one if a manager is not a senior manager and the value of zero if otherwise. This variable is lagged by one year.

Individual competency: Competency assessments have been done to share the mission and goals of this firm. All managers need to be assessed every year. This competency assessments evaluate three competencies: customer-related competency, people-related competency, and ethics-related competency. All items were measured using one-to-seven scale.

## 4. Results

[Table 1] shows descriptive statistics and correlations of variables used. There are significant associations among predictor variables and control variables. Variance inflation factors (VIF) were calculated to check the multicollinearity. VIF factors range from 1.22 to 2.34, which is below the rule-of-thumb cut-off of 10[20].

There is a weak positive correlation between exploration work assignments and tenure, indicating that exploration work was assigned to younger managers. In addition, there is a weak negative correlation between exploration work assignments

and education(master), meaning that less exploration work was given to managers who hold a master's degree.

Although the impacts of individual competency and education (bachelor) on project performance is not significant, the signs of coefficient in [Table 3] and [Table 4] are different. With regard to education (bachelor), a manager who has a bachelor degree may be good at an exploitation project than an exploration project. With regard to individual competency, I suspect that competency may be aligned with an exploitation project rather than an exploration project.

**Table 4. Results of logistic regression of project performance (Cluster: manager)**

DV: Project performance (t+1)		
Measure	Model 2	
	$\beta$	s.e.
Individual competency (t)	-0.045	(0.289)
Age (t)	-0.051	(0.034)
Tenure (t)	0.003	(0.021)
Education 1 (Bachelor)	-0.101	(0.291)
Education 2 (PhD)	0.220	(0.212)
Position==Manager (t)	-0.002	(0.196)
<b>Ambidextrous work assignment (t)</b>	<b>0.449*</b>	<b>(0.247)</b>
<b>Exploitation work assignment (t)</b>	<b>-0.268</b>	<b>(0.231)</b>
Cut-off 1	-4.271	(2.218)
Cut-off 2	-3.449	(2.206)
Cut-off 3	-2.126	(2.186)
Cut-off 4	-1.150	(2.197)
N	504	
Chi-square	17.27	
df	9	
-2 log likelihood	-216.94	
pseudo R2	0.03	

$\rho^* < 0.05$ ,  $\rho^{**} < 0.01$ ,  $\rho^{***} < 0.001$ . ; two-tailed tests

Three hypotheses were developed to investigate the effects of the three types of work assignments on the subsequent project performance. Model 1 shows that pervious assignment of exploitation work has a positive and significant effect on performance of the subsequent exploitation project compared with previous assignment of exploration work. Hypothesis 1 is supported. Model 2 shows that the assignment of exploration work has no effect on performance of the

subsequent project and the assignment of ambidextrous work is positively associated with performance of the subsequent project. Hypothesis 2 is not supported and Hypothesis 3 is supported.

**Table 5. Summary of results**

Hypothesis	Results
H1: Exploitation experience	Supported
H2: exploration experience*	Not supported
H3: ambidextrous experience*	Supported

\* Competing hypothesis

## 5. Conclusions

I reveal the effects of three types of work assignments (i.e., exploration, exploitation, and ambidextrous work assignments) on project performance. First, the assignments of exploitation project help managers improve the performance of next exploitation project because same knowledge and skills can be used for the next exploitation project. However, such effects are limited in that only exploitation work assignments are considered.

Second, The assignment of both exploitation and exploitation gives good work environments for managers compared with exploration and exploitation work assignments. These results are line with the arguments in the current exploration and exploitation literature[21][22]. This provides what the best way to assign exploration and exploitation projects to managers.

The contributions of this study are two folds. This study give a contribution to R&D management research. The project assignments to managers are critical issues in managing R&D projects[3]. The results of this study suggest that managers assigned to both exploration and exploitation projects are more likely to performance better. Thus, this study provides how projects need to be assigned to managers.

Second, this study contributes to the ambidexterity

literature. Exploration and exploitation have been discussed from the viewpoint of organization. The meaning of the two to individuals has been less explored. This study shows that exploration and exploitation can be understood in terms of individual motivation and work environments.

This study also has limitations. The longer observations on managers may provide more in-depth analysis. In addition, organizational factors such as team diversity or team cohesion need to be considered in the future research because this study focused on manager's characteristics.

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