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Practical Project Behavior Management Methods for Large-scale IT Projects

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대규모 IT 프로젝트를 위한 실용적 행태관리 방안

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Abstract Technology developments accelerate the change of the society and companies with unparalleled pace, so large scaled projects are in progress urgently. Large scaled projects deal with high technologies and massive tasks, and these need enormous labor force and costs, it is necessary to manage strategic conflicts based on human psychology and complex system theory. However, traditional management plan fails to suggest practical mechanism for successful projects. We study failure cases and key elements, leadership for projects, and suggest project management plan with psychological and behavioral economy approach by focusing on complexity and conflict structure on large scaled projects. Project behavior management plan, suggested in this study, is designed with phased strategy and practice to solve the failure of large scaled IT projects originally and preemptively. We verified the effectiveness of behavior management plan suggested by investigating experts and working groups, and stable projects are to be progressed with introducing this plan on large-scaled projects.

요 약 본 기술의 진화는 역사상 유래 없는 속도로 사회와 기업의 변화를 가속하고 있고 요구되는 대응을 위해 대형 IT 프로젝트가 긴박하게 추진되고 있다. 고도의 기술과 대규모 업무를 다루고, 막대한 인력과 비용이 투입되는 대규모 프로젝트는 인간 심리와 복잡계 이론에 기반한 전략적 갈등관리가 요구되나, 기존의 관리방법은 이에 부응하는 실용적 기제를 제시하지 못하는 실정으로 프로젝트 실패가 증가하고 있다. 본 연구는 적절한 해법을 찾기 위해 프로젝트 실패 현황과 성과 요인, 프로젝트 리더십에 대해 관련 연구하였고, 대형 IT 프로젝트의 복잡성과 갈등구조에 주목하여 기존의 프로젝트 관리방안에서는 간과하였던 심리학적, 행동경제학적 접근을 접목하였다. 논문에서 제시한 프로젝트 행태관리 방안은 대규모 IT 프로젝트의 주요 실패 행태들을 근원적이고 선제적으로 해소할 수 있는 프로젝트 단계별 행태관리 전략과 실천적 프랙티스를 제시한다. 해당 현장 전문가 및 실무자 그룹의 설문조사를 통해 제안된 행태관리 방안의 유효성에 대한 기대를 검증하였고, 본 방안을 대형 프로젝트 관리에 도입함으로써 보다 안정적인 프로젝트 성공 기반을 확보할 수 있다.

Keywords : Behavior Management, Project Mentality Management, Conflict Management, IT Project Management

1. Introduction

Researchers have found that one-fifth of the global GDP is invested in a variety of business projects[1] but with a very low success rate. When it comes to IT projects, the rate of failure is even higher than the average: one out of 6 projects exceeding the original budget by two times, and around 70% suffering from a delay of schedule.[2]

However, business projects must proceed despite

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such a low success rate, and this requires more active countermeasures to failure. Under this circumstance, this study suggests a series of practical behavior management methods for IT projects. The adoption of behavior management methods is expected to help project participants perform their tasks in a timely manner with more contribution, and furthermore, increase their motivation and loyalty to the organization.

2. Related Researches

2.1 Status of Project Failures

Based on the definition that the success of a project depends on the achievement of all of its goals on budget, schedule and quality, it is so natural to see the high failure rate of large-scale IT projects. According to the research by PWC, only 2.5% of large-scale projects result in success[3]. In particular, many projects failed to meet the schedule, which was mainly due to inaccurate estimate, delay of milestone achievement, lack of sponsorship, low-quality goals and objectives, change of scope during the process, insufficient resources, low-quality communication, and lack of participation of stakeholders.

2.2 Project Performance Factors

The performance of a project can be measured by analyzing whether to meet the initial expectations for target cost, time, and results[4].

Researches on project performance factors generally take two types of approaches: discovering success factors as seen in the Fig. 1 and identifying and managing risk factors as shown in the Fig. 2 [27]. The former provides factors that can increase the possibility of project success but does not suggest any method to strengthen those factors. The latter deals with project risk factors and how to manage them, but does not consider behavior management or suggest specific practices.

The D&M IS Success Model, the most representative research on IT project performance, classified IT project performance standards into six categories of system quality, information quality, information use frequency, user satisfaction, individual influence, and organizational influence, based on which it suggested performance model and performance indicator.

For the significant factors affecting project performance, Aladwani(2002) suggested technology features, project characteristics, job characteristics, human resource characteristics, organizational characteristics, and business process. And Dai andWells(2004) emphasized the importance of project management, while Frame(1994) and Desouza and Evaristo(2006) pointed out organizational culture and environmental factors.

Project Success Factors		Researchers
Project Progress	Overall process	Phan et al.(1995), Lederer and Sethi(1996)
	Success factors in each development phase	Deephouse et al.(1995)
	Scope management activities	Park Bong-Goo (2009)
Participant Qualifications	System analyst qualifications	Nord and Nord(1997)
	PM/PMO competency and leadership	Bae Jae-Kwon, Kim Jin-Hwa, Kim Sang-Yeol(2008), Kim Hwa-Young, Kang So-Rah(2008), Kim Eun-Hong, Kim Hwa-Young (2006)
Risk Management	Risks of development projects	Nidumolu (1996)
	Risk management	Barki et al.(2001), Seo Chang-Kyo, Jeong Eun-Hee(2003)
User	User participation	McKeen and Guimaraes (1997)
	User immersion	Tait and Vessay (1998)
	User influence	Edstrom (1997)
Communication	Knowledge transfer process	Lee Sang-Hoon, Lee Ho-Geun (2007)
	Communication frequency and methods	Kim Won-Seob(1998)
Others	Program complexity	Nystedt(1999)
	Process maturity	Lee Sang-Yeob(2000)
	Project inspection	Kim Dong-Soo, Yang Gyeong-Sik, Kim Hyun-Soo (2006)

Fig. 1. Researches on Project Success Factor

Researcher	Description
Applegate (1996)	Suggesting risk factors obtained from risk cases in the form of checklist. Requiring accuracy of user requirements
Higuera (1996)	Clarifying risk management methods. Requiring the list of user requirements
Barki et al. (1993)	Conducting empirical study on the impact of risk factors and management methods on project performance
Moynihan (1997)	Suggesting key risk factors based on expert interviews. Emphasizing a client's clear understanding of requirements and change scope
Schmidt et al. (2001)	Suggesting the development of risk factors from the perspective of project management. Clarifying user requirements
Barki et al. (2001)	Conducting empirical study on the impact of the response to risks on project performance based on risk checklist

Fig. 2. Researches on Project Risk Factor

2.3 Project Leadership

In connection with the aforementioned project success factors, we conducted a research on project leadership which has recently been drawing much attention from the industry.

A project requires temporary efforts to produce a unique product, service, or result, and project management is designed to apply relevant knowledge, skills, tools and technologies to project activities so as to meet the project requirements[5]. The successful implementation of a project requires a high level of competency of project managers. That is to say, excellent leadership is required from project managers who will take charge of various internal/external difficulties and risk factors, customer satisfaction, and team cooperation. In particular, IT project performance is significantly affected by the competence and leadership of project managers[6].

Generally, researches on project manager leadership are based on six theories[7,8]. From 1940s to 1960s, there were two prevailing leadership theories: "Leadership Trait" theory that argues leadership is an inherent trait based on the premise that leaders have certain common attributes, and "Leadership Style/Behavior" theory that asserts leaders possess unique behavioral patterns and styles.

From 1960s to 1970s, leadership situational theory that argues the effectiveness of leadership can be different depending on the situation was prevalent [9,10], pointing out that situational factors such as member characteristics, organizational size and characteristics have much influence on the display of leadership.

From 1980s to 1990s, a number of researches were performed on "Visionary or Charismatic Leadership" that uses organizational changes for success, and Bass, the most representative researcher in this area, classified the type of leadership into "Transformational Leadership" that includes charisma, individual consideration and intellectual stimulation, and "Transactional Leadership" that describes how a leader and its followers exchange goal achievements and compensations [11].

From the late 1990s, "Emotional Intelligence Leadership" theory had drawn much attention, and Goleman, Buyatzis, and McKee argued that a leader's emotion, rather than intelligence, has more influence on the performance of team members[12].

More recently, the focus of researches on project manager leadership has been moved to "Leadership Competency"[12, 13, 14, 15, 16, 17]. Dulewicz and Higgs[15] classified leadership competency defined in the existing researches into 4 types: ‘Cognitive’, ‘Behavioral’, ‘Emotional’, and ‘Motivational’, and re-categorized 15 sub-competencies into intellectual competency(IQ), managerial competency(MQ), and emotional competency(EQ).

Classification	Competency
Emotional Competency (EQ)	Efficiency Orientation
	Planning
	Initiative
	Attention to detail Flexibility
	Self-confidence
Cognitive Intelligence Competency (IQ)	Concept
	Systems Thinking
	Pattern Reorganization
Social Competency (SQ)	Networking
	Empathy
	Negotiating
	Persuasiveness
	Developing others
	Group Management
	Oral Communication
	Social Objectivity

Fig. 3. Leadership Competency Structure

Boyatzis and Ratti[18] conducted an empirical analysis to classify the leadership competency of project managers into Emotional Competency(EQ), Cognitive Intelligence Competency(IQ), and Social Competency(SQ), and each sub-competency is described in the Fig. 3.

Emotional Competency(EQ) refers to a project manager's qualifications such as efficiency orientation, planning, leadership, self-discipline and flexibility, while Cognitive Intelligence Competency(IQ) means job performance capabilities such as awareness of project concept, systematic thinking, and recognition of work patterns. Social Competency(SQ) indicates a project manager's capability to establish a network with team members based on mutual interaction; reach a consensus with, negotiate with and persuade them based on communication; and develop and manage their capabilities.

The above researches on project leadership confirmed that not only cognitive intelligence competency but also emotional competency and social competency are very important factors in successfully implementing a project.

2.4 Other Related Researches

Besides, we performed a research on papers and books related to behavior management, the so-called global project management standard PMBOK(Project Management Body of Knowledge), and international standard for project management, ISO21500 [19,20,21,22,23].

3. Large-Scale IT Project Behavior Management Methods

3.1 Complexity and Conflict Management of Large-Scale IT Projects

The successful implementation of large-scale IT projects requires extensive use of outside technical personnel. In Korea, approximately 2-300 members participate in each next-generation project although the number can be different depending on the cost and scope of the project. The scale of a project is in proportion to its complexity which includes business complexity, technology complexity, communication complexity, and member relationship and cooperation complexity.

Since business complexity and technology complexity are directly related to the configuration of the IT system to be established, exclusive personnel have been assigned for active management, and in the software engineering aspects, the ALM(Application Life—cycle Management) and S/W Visualization Case technologies are playing a role in realizing those functions through automatic systematization.

However, it is a reality that communication complexity and member relationship and cooperation complexity are not being properly managed despite their high increase rate in proportion to project scale and huge impact on project performance. The guidelines on stakeholder management and communication management suggested by PMBOK are not enough to effectively deal with various conflicts and issues related to communication, relationship, and teamwork taking place in actual projects.

3.2 Project Conflict Properties from Behavior Management Perspective

1	Humans, as an individual, have independency, naturality, and autonomy.
2	Humans, as a member of society, have social relation features such as collective behavior, competition, acknowledgement, self-actualization, and mutual interaction.
3	A project is implemented by individuals and groups belonging to an organization, and their behaviors can be different depending on organizational structure, regulation and system, commend system and atmosphere, and work design.
4	A project is implemented based on the contract among interested organizations and is internally and externally affected by politics, authorities, lobbying, and exercise of forces.

Fig. 4. Inevitable Conflict Attribute of Project

From the psychological perspective, a project inevitably starts and ends with conflicts, and this is well described by the theses in the Fig. 4. In this

regard, conflicts inevitably take place in a project and thus, proactive and strategic conflict management is considered as one of the success factors of a project.

3.3 Large-Scale IT Project Behavior Management Methods

For proactive project conflict management, this paragraph suggests a series of behavior management methods in each phase of preparation, launching, analysis/design, and implementation/testing as described in the Fig. 5.

Phase	Project Behavior Management Methods
Preparation	Premorterm
	Self-Checklist
Launching	Participant Psychology Evaluation
	H-Factor Personality Test
Analysis /Design	Preemptive Change Management
	Collapse of Willful Blindness
Implementation /Testing	Principle of Consistency, Positive Conversation
	Image Training through Self-Affirmation and Visualization

Fig. 5. Phased Behavior Management Method

3.3.1 Preparation Phase

In the phase of preparation, behavior management methods of Premorterm and Self-checklist are used.

1) Premorterm

Premorterm, named 'Die in advance' in Korean, is a method that allows participants to figure out the causes of failure based on the assumption that the project has failed.

1. Introduction of project	The presenter summarizes and announces the overall plans for the project.
2. Declaration of failure	The presenter declares the failure of the project.
3. Analysis of causes	The members takes a few minutes to individually describe all possible and predictable causes of failure.
4. Announcement of causes	All members take turns in making a presentation on the causes of failure (one for each).
5. Follow-up measures	The presenter reviews the causes and strengthens the initial plans.

Fig. 6. Premoterm Process

While the existing risk management takes an approach that predicts the future based on the present, Premorterm method assumes a situation where participants figure out why the project has failed. In the phase of preparation, Premorterm method enables participants to identify the worries and fears in their mind, and understand each other's position and difficulties. The procedure of Premorterm method is described in the Fig. 6.

2) Self-Checklist

According to behavioral economist Daniel Kahneman, humans happen to show irrational behavior and make unreasonable decisions due to heuristics and bias. Based on his theory, we defined human emotions & psychology bias in the Fig. 7.

Action-Oriented Biases	-Over-optimism -Excessive self-confidence -Neglect of competitors
Interest Biases	-Ineffective incentives -Inappropriate attachment -No perception of corporate goals
Social Biases	-Group thinking -Unquestioning obedience to the management
Stability Biases	-Anchoring & lack of adaptation -Sunk cost bias/fallacy -Loss aversion -Status quo bias
Pattern-Recognition Biases	-Hindsight bias -Case-based management -Inference of untruth/misleading of the truth -Storytelling -Champion bias

Fig. 7. Human Psychology Bias System

Psychology Bias Type	Coping Mechanism
Action-Oriented Biases	-Increasing the awareness of uncertainty
Interest Biases	-Defining the details of interest biases -Verifying the adequacy and propriety of the details
Pattern-Recogniti on Biases	-Changing perspectives -Suggesting different frames
Stability Biases	-Changing the tendency to pursue stability -Increasing the awareness of opportunity loss and potential risk
Social Biases	-Discussing the side effects of deindividuation/depersonalization -Promoting critical/objective thinking

Fig. 8. Coping Mechanism for Psychology Bias

Self-checklist method enables project members to check whether they are caught in an emotional trap. The self-check in the phase of preparation allows more reasonable judgement and rational response regarding the overall relationship and communication in the following phase, and the Fig. 8 suggests an effective coping mechanism for each type of psychological bias.

3.3.2 Launching Phase

In the phase of launching, participant psychology evaluation and H-factor checklist are used.

1) Participant Psychology Evaluation

Participant psychology evaluation method is based on the contention of Benoit Hardy-Vallee that emphasizing a member's psychological and spiritual sense of calling and responsibility, rather than rational facts, is more effective in successfully implementing a project, and a project behavior checklist consisted of 9 items is defined in the Fig. 9 based on the analysis of common behavior of failed projects. The checklist is recommended to be used on a regular basis since the initial use at the launching phase, and proper complementary measures need to be taken according to the results to prevent project failure.

1	Are project members aware of what they are expected to do?
2	Are team members motivated enough to achieve results/performance?
3	Do team members feel their opinions are accepted? Do they feel that they can freely express their opinions without direct/indirect pressure/interference?
4	Is there anyone who can motivate team members and find what they did right?
5	Do team members care about each other in terms of project goal and quality achievement?
6	Do team members treat project stakeholders with respect and trust?
7	Do stakeholders trust the project team? Do they feel the team deliver?
8	Are stakeholders connected to the project team? Do they have a certain role?
9	Will stakeholders use the service provided by the project team even after the project completion? Will they recommend the team and members to other projects?

Fig. 9. Project Failure Behavior Checklist

2) H-Factor(Honesty-Humility) Checklist

H-Factor Personality Test, which focuses on H-factors (Honesty-Humility) among personality elements, allows the identification of ineligible members and preparation of countermeasures in the phase of launching.

According to psychology theories, people with a high level of honesty do not generally control others or like pretense, and do not think they are superior to others, which makes them appropriate members for creating and maintaining a sound collaborative culture. Since they are also fair-minded and have a law-abiding spirit, they tend to take more responsibility for their tasks in the project. Based on the personality inventory suggested by Michael C. Ashton who published <The H Factor of Personality>, the H-factor evaluation items for project participants are defined in the Fig. 10.

No.	Type	Description
1	+	I will not flatter my boss even if it will affect my promotion or pay increase.
2	-	I might steal about tens of millions won from others if I do not get caught.
3	+	Making a lot of money is not that important in my life.
4	-	I think I am more respectable than others.
5	-	I will ingratiate myself with someone from who I want to get something.
6	+	I will not take a bribe regardless of the amount.
7	-	I like expensive and luxurious goods.
8	-	I want others to treat me as someone of high social position
9	+	I will not pretend to like someone for requesting something.
10	-	I am tempted to pass a counterfeit note if I do not get caught.

Fig. 10. H-Factor(Honesty-Humility) Checklist

To each item, participants give marks based on the five-point scale from 1(Absolutely Negative), 2(Negative), 3(Neutral), 4(Positive), to 5(Absolutely Positive). The marks given are combined as they are for Type, but converted like 1->5, 2->44, 4->2, and 5->1 for '-'Type. When the total marks are over 44, the level of honesty is much higher than the average; when between 36 and 43, somewhat higher than the average; when between 28 and 35, about the average; when

between 20 and 27, somewhat lower than the average; and when below 19, very lower than the average. For more accurate evaluation of H-factors, the result of a questionnaire completed by a person who knows the surveyee very well along with self-evaluation must be considered at the same time.

3.3.3 Analysis/Design Phase

In the phase of analysis/design, Preemptive Change Management and Collapse of Willful Blindness are used.

Unlike the existing methods of its kind that managed changes for the new system in the phase of project implementation, preemptive change management is initiated in the early stage of project, establishing change management strategies for each phase/target from project analysis to implementation and taking preemptive actions to possible changes. As shown in the Fig. 11, this method induces the early identification and confirmation of requirements, and secures the foundation of success of the project.

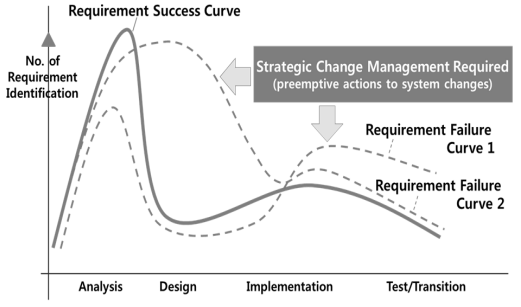

Fig. 11. Early Requirement Identification by Preemptive Change Management

Collapse of Willful Blindness is an approach designed to overcome the human social nature of disregarding or avoiding uncomfortable issues, allowing the early detection of risks and prevention of delay in taking measures through proactive encouragement and management.

3.3.4 Implementation/Testing Phase

In the phase of implementation/testing, the Principle of Consistency, Positive Conversation, and Image Training through Self-Affirmation and Visualization are used.

The Principle of Consistency, defined by Robert Cialdini in the Psychology of Persuasion, clarifies that human beings tend to maintain consistency with what they said or did. In the phase of implementation/testing, participants cannot help but feel nervous since the configuration of operating software is visualized and development and progress are controlled. Under this circumstance, operating a mechanism that enables members to recall and confirm their initial promise and intention contributes to strengthening the driving force in the later phase of project.

Moreover, the method promotes the success of project and the quality of products by visualizing the status of compensation and satisfaction and encouraging image training on the outcomes.

4. Verification

4.1 Verification Model

The verification model in the Fig. 12 was used to verify the behavior management methods suggested in the body.

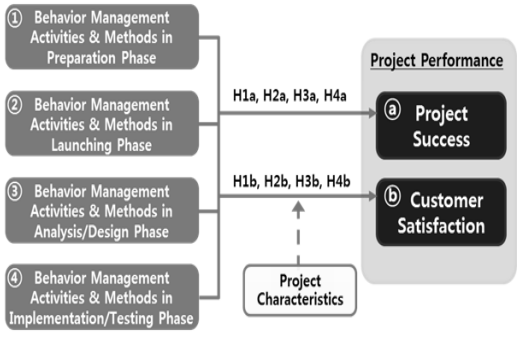

Fig. 12. Definition of Verification Model

4.2 Hypotheses for Verification

A series of hypotheses were established as below in order to understand whether the project behavior management activities and methods suggested in this

research have a positive impact on project success and customer satisfaction.

-Hypothesis 1a: Premorterm and Self-Checklist in the phase of preparation will have a positive impact on project success.

-Hypothesis 2a: Participant Psychology Evaluation and H-Factor Personality Test in the phase of launching will have a positive impact on project success.

-Hypothesis 3a: Preemptive Change Management and Willful Blindess in the phase of analysis/design will have a positive impact on project success.

-Hypothesis 4a: Principle of Consistency/Positive Conversation, Self-Affirmation, and Visualization in the phase of implementation/testing will have a positive impact on project success.

-Hypothesis 1b: Premorterm and Self-Checklist in the phase of preparation will have a positive impact on customer satisfaction.

-Hypothesis 2b: Participant Psychology Evaluation and H-Factor Personality Test in the phase of launching will have a positive impact on customer satisfaction.

-Hypothesis 3a: Preemptive Change Management and Willful Blindess in the phase of analysis/design will have a positive impact on customer satisfaction.

-Hypothesis 4b: Principle of Consistency/Positive Conversation, Self-Affirmation, and Visualization in the phase of implementation/testing will have a positive impact on customer satisfaction.

4.3 Operational Definition of Variables for Verification

The phased behavior management activities & methods, independent variables used in the verification model, are defined as behavior management activities & methods in the phases of preparation, launching, analysis/design, and implementation/testing according to the model suggested in the body. In addition, the operational definition of project success and customer satisfaction variables and control variables, established as dependent variables, is described in the Fig. 13. The relevant questionnaire based on a 7-point Likert scale is included in the <Appendix>.

Classification		Definition
Independent Variable	Phased behavior management activities & methods	Referring to the phased behavior management methods suggested in the Fig. 4
Dependent Variable	Project success	Evaluating based on the measurement indicators including target schedule/deadline, cost, and quality achievement
	Customer satisfaction	Evaluating based on the customer satisfaction with the progress process since project launching and at the time of system operation
Control Variable	Project scale	Information system development projects of over 5 billion won are classified into mid-to-large scale and those of below 5 billion won into small-scale
	Project difficulty	Classified into high/medium/low considering project development methodologies, and task and technology complexity

Fig. 13. Operational Definition of Variables

4.4 Sample Selection and Data Collection

We developed investigation questions by referring to relative studies, and decided the final questions by interviewing project experts.

Based on the confirmed questionnaire items, a website was established to conduct a survey on randomly selected targets including project managers(PM), project leaders(PL), developers, and consultants with experience of participating in large-scale IT projects. As a result, a total of 106 survey data were collected, and the surveyees were not allowed to submit the questionnaire if they did not answer to all items.

A total of 96 survey data except 10 with low reliability were used as basic data to produce the following statistical results in the Fig. 14. The distribution of respondents shows that 42.7% of them took the role of PM in a project and 91.7% had the position over general manager/deputy general manager

in their organization, meaning that respondents generally had a proper understanding of project behavior management and a possibility of providing quality information.

5. Data Analysis and Hypothesis Verification

In the phase of data analysis, a validity analysis to check the accuracy of measurement tools and a reliability analysis to confirm consistency were performed based on the collected data, and a multiple regression analysis was also conducted to verify the hypotheses. For data analysis, SPSS 10.0 was used.

Item	Classification	No. of persons	Ratio (%)	Item	Classification	No. of persons	Ratio (%)
Role	PM	41	42.7	Project Type	New development	61	63.5
	PMO	7	7.3		System improvement	12	12.5
	PL	26	27.1		Package application	20	20.8
	Developer	22	22.9		Others	3	3.1
Position	Below Assistant Manager	8	8.3	Project Scale	Below 0. 5 billion	31	32.3
					Below 5 billion	29	30.2
	Over General Manager	88	91.7		Below 10 billion	19	19.8
					Over 10 billion	17	17.7

Fig. 14. Result of Statistics

5.1 Validity Analysis

In order to verify whether the measurement tools properly measured the construct to be studied, a factor analysis was conducted on the questionnaire items for each independent and dependent variable. For factor analysis, Varimax-rotated solution was used.

The Fig. 15 shows the results of analyzing the factors related to the phased project behavior management activities & methods: items related to behavior management methods in each phase have a single characteristic. 6 items in the preparation phase, 6 items in the launching phase, 5 items in the analysis/design phase, and 5 items in the implementation/testing phase were used for analysis.

The Fig. 16 shows the results of analyzing the factors regarding the questionnaire items on project performance: 4 items on project success and 4 items on customer satisfaction that display distinctive characteristics between project success and customer satisfaction were used.

Classification	Success Factor			
	Preparation	Launching	Analysis /Design	Implementation/Testing
Behavior Management In Preparation1	.785	.674	.225	.220
Behavior Management In Preparation2	.678	.785	.463	.433
Behavior Management In Preparation3	.848	.844	.222	.212
Behavior Management In Preparation4	.867	.793	.301	.251
Behavior Management In Preparation5	.844	.846	.169	.143
Behavior Management In Preparation6	.723	.718	.379	.352
behavior management in launching1	.785	.789	.225	.213
behavior management in launching2	.678	.670	.463	.421
behavior management in launching3	.848	.840	.222	.253
behavior management in launching4	.867	.859	.301	.352
behavior management in launching5	.844	.823	.169	.132
behavior management in launching6	.723	.730	.379	.328
Behavior Management in Analysis/Design1	.372	.365	.005	.067
Behavior Management in Analysis/Design2	.161	.152	.388	.299
Behavior Management in Analysis/Design3	.237	.221	.294	.314
Behavior Management in Analysis/Design4	.147	.137	.392	.423
Behavior Management in Analysis/Design5	.408	.382	.458	.472
Behavior Management Implementation/Testing1	.271	.260	.808	.789
Behavior Management Implementation/Testing2	.239	.245	.627	.597
Behavior Management Implementation/Testing3	.163	.172	.853	.874
Behavior Management Implementation/Testing4	.275	.288	.799	.821
Behavior Management Implementation/Testing5	.280	.301	.841	.804

Fig. 15. Factor Analysis Result of Behavior Management Activities and Methods

Classification / Success Factor	Project Success							
	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8
Project Success	.807	.821	.820	.825	.286	.320	.267	.244
Customer Satisfaction	.375	.242	.181	.417	.834	.905	.863	.570

Fig. 16. Factor Analysis Result of Project Performance

5.2 Reliability Analysis

A reliability analysis was conducted to check the possibility of obtaining the same measurement values when repeating the measurement of internal consistency. For the measurement method, Cronbach's alpha test was

used. Generally, when the value of Cronbach's alpha is over 0.6, it is considered that reliability is guaranteed. In this regard, since the alpha values of each variable, as seen in the Fig. 17, are all above 0.8, internal consistency is considered to be guaranteed.

Variable		No. of items	Cronbach's alpha value
Independent variable	Behavior management in preparation	6	0.9325
	Behavior management in launching	6	0.9318
	Behavior management in analysis/design	5	0.9173
	Behavior management in implementation/testing	5	0.9185
Dependent variable	Project success	4	0.8982
	Customer satisfaction	4	0.9432

Fig. 17. Result of Reliability Analysis

5.3 Direct Impact Analysis

To analyze the characteristics of the variables used in the model prior to the analysis of direct impacts, descriptive statistics quantity was examined as seen in the Fig. 18. Looking at the average value and standard deviation of each variable, they are evenly distributed, which means there is no systematic bias that can affect the result.

	No.	Minimum value	Maximum value	Average	Standard deviation
Behavior management in preparation	96	2.33	7.00	5.4273	1.2054
Behavior management in launching	96	2.27	7.06	5.4273	1.2054
Behavior management in analysis/design	96	1.60	7.00	5.1833	1.2135
Behavior management in implementation/testing	96	1.00	6.80	4.5500	1.5179
Project success	96	1.75	7.00	5.1146	1.2576
Customer satisfaction	96	1.67	7.00	5.2515	1.3338

Fig. 18. Descriptive Statistics Quantity of Variables

In addition, the result of analyzing the existence of multicollinearity among independent variables shows that the tolerance limit of all variables is above 0.1 Fig. 19, and the VIF(Variance Inflation Factor) is below 10, confirming that there is no problem with multicollinearity among variables.

Hypothesis	Independent Variable	Dependent Variable	Tolerance Limit
H1a	Behavior management in preparation	Project success	0.511
H2a	Behavior management in launching		0.511
H3a	Behavior management in analysis/design		0.488
H4a	Behavior management in implementation/testing		0.459
H1b	Behavior management in preparation	Customer satisfaction	0.511
H2b	Behavior management in launching		0.511
H3b	Behavior management in analysis/design		0.488
H4b	Behavior management in implementation/testing		0.459

Fig. 19. Resuls of Multicollinearity Analysis

The Fig. 20 below shows the results of conducting multiple regression analysis to identify the direct impact of behavior management activities on project performance. The analysis of the direct impact on project performance shows that the result of a two-tailed test was significant when the standardized coefficient was within 0.694, 0.694, 0.204 and 0.177, and the significance probability was within 0 .000, 0 .000, 0.021, and 0.023 in the phases of preparation, launching, analysis/design, and implementation/testing, respectively.

Hypothesis	Independent Variable	Dependent Variable	Standardized Coefficient	T Value	Significant Probability
H1a	Behavior management in preparation	Project Success	.694	7.809	0.000
H2a	Behavior management in launching		.694	7.809	0.000
H3a	Behavior management in analysis/design		.204	2.346	0.021
H4a	Behavior management in implementation/testing		.177	2.312	0.023
H1b	Behavior management in preparation	Customer Satisfaction	.694	9.273	0.000
H2b	Behavior management in launching		.177	2.312	0.023
H3b	Behavior management in analysis/design		.694	9.273	0.000
H4b	Behavior management in implementation/testing		.204	2.346	0.021

Fig. 20. Result of Analysis Multiple Regression

When it comes to project performance from the perspective of customer satisfaction, the result of a

two-tailed test was significant when the standardized coefficient was within 0.694, 0.694, 0.204, and 0.177 and the significance probability was within 0.000, 0.000, 0.021, and 0.023 in thephases of preparation, launching, analysis/design, and implementation/testing, respectively.

5.4 Hypothesis Verification

Based on the multiple regression analysis, the results of analyzing the research model established in the initial phase were described in the Fig. 21. When considering the hypotheses established in the initial phase, H1a, H2a, H3a, H4a, H1b, H2b, H3b, and H4b were all adopted.

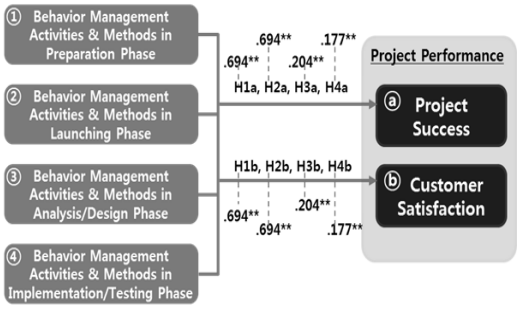

Fig. 21. Analysis Result of the Research Model

5.5 Impact Analysis of Project Characteristics

For impact analysis of each project characteristic, project scale and difficulty were used as control variables and data were classified to conduct a multiple regression analysis. As a result, it was confirmed that project success and satisfaction increased in proportion to project scale and difficulty.

6. Conclusion

A series of systematic measures have been applied and developed in the project sites for successful information system construction. Those measures include best practices such as CMMI(Capability Maturity Model Integration), certified project management process and more recently, ALM(Application Lifecycle Management) and SW Visualization technologies. Nevertheless, a number of projects still fail to fulfill their original plans or achieve their quality goals, and cancellation and failure of large-scale IT projects are continuously taking place.

Many projects end up failure mainly because they did not effectively manage or define essential factors such as project behavior, culture and emotion. In this regard, this study focuses on the lack of the current behavior management activities, and conducted an empirical research to identify the impacts of behavior management activities on project performance. For the difficulties of large-scale IT projects that could not be solved by the existing project management methods, we carried out an interdisciplinary research to find the solution in social sciences such as psychology, organizational behavior, and communication.

Related researches confirmed that agile methodologies, which are taking center stage in the S/W service development area, share context with project behavior management. However, agile methods are usually used in small-scale projects or self-service/solution development projects and thus, many obstacles exist in adopting them in large-scale IT projects such as next-generation system. Even if adopted, they might not result in the same effects as in small-scale projects or even cause some side effects. Also, large-scale projects have behavioral issues and difficulties at the level of individual, group, and organization that cannot be resolved only by agile practices. Against this backdrop, it is urgent to adopt project behavior management methods in large-scale IT projects such as next-generation system.

The results of this research are as follows. First, from the perspective of project success, the behavior management activities & methods in the phases of preparation and launching have the biggest impact on project performance, followed by those in the phases of analysis/design and implementation/testing. This implies

that the initial set-up is critical in successfully implementing a project; identification of participant attitudes, characteristics and overall teamwork, preparation of preemptive measures, creation of sound team culture, and adoption of behavior management activities and methods in the launching phase have significant impact on project success.

Second, from the perspective of customer satisfaction, the behavior management activities and methods in the phases of preparation and launching have a huge impact on the level of customer satisfaction, followed by those in the phase of implementation/testing rather than of analysis/design. This represents the attributes of IT projects, which means that the effective behavior management activities in the phase of implementation/testing can lead to customer satisfaction and trust by encouraging participants to recall their initial goals, visions, passion and resolutions even in the latter phase of the project. Although preemptive change management and collapse of willful blindness in the phase of analysis/design had a relatively weaker effect on project performance, collapse of willful blindness might not be suitable for the domestic IT industry, and even if adopted, it might not be that effective. However, the behavior management activities in the phase of analysis/design have a positive relationship with customer satisfaction.

Third, the bigger scale of a project leads to the bigger impacts of behavior management activities on project performance, and the smaller scale leads to the smaller impacts. In addition, the higher level of difficulty leads to the higher effectiveness of behavior management activities and methods on project performance, and the lower difficulty leads to the lower effectiveness. This indicates that the bigger scale and higher difficulty of a project inevitably result in the necessity of relationship and communication management and the increase of complexity, which leads to the enhancement of value and effect of behavior management activities.

By integrating the phased approaches suggested in this research and leading large-scale IT/SI projects, the sources of many risk factors can be prevented and the stable foundation of project implementation can be secured. Furthermore, the loyalty and job satisfaction of participants can be increased to result in excellent project performance, solid partnership, and customer satisfaction, which provide a foundation for sustainable growth after the project completion.

This research confirmed that the psychology-based behavior management, which was neglected in the existing studies and practices, has a very significant impact on project performance, and large-scale projects with the bigger scale and higher level of difficulty can have more possibilities of consolidating their foundation for success by adopting behavior management activities and methods.

This research is expected to increase the awareness of necessity of phased behavior management activities for project success and customer satisfaction, and to see a variety of follow-up studies, spread of adoption, use for verification, and improvement and expansion of methods.

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[Appendix]

<Questionnaire Items>

Independent Variable	Category	Questionnaire Item
Behavior Management Activities & Methods in Preparation	Premortem	Conduct a premortem within the project team in the preparation phase
		Conduct a premortem within the vendor in the preparation phase
		Conduct a joint-premortem with the client in the preparation phase
	Self-Checklist	Conduct a self-examination on the emotion & psychology bias of project participants in the preparation phase
		Hold a session to share the results of self-examination on the emotion & psychology bias of participants
		Attach the result of the self-examination to participant desks as a reminder
Behavior Management Activities & Methods in Launching	Participant Psychology Evaluation	Conduct a 'Participant Psychology Evaluation' within the project team in the launching phase
		Conduct a 'Participant Psychology Evaluation' within the vendor including relevant teams in the launching phase
		Conduct a 'Participant Psychology Evaluation' with the client and PMO in the launching phase
	H-Factor Personality Test	Conduct a 'H-Factor Personality Test' on all the concerned parties
		Hold a session to share the plans, thoughts and ideas of participants on the subjects of project goals, individual goals, project teamwork, and cooperation as well as the results of 'H-Factor Personality Test'
		Replace members who have an extremely different value system based on the test results, and display project and individual goals, missions, and desirable attitudes in the project room
Behavior Management Activities & Methods in Analysis/Design	Preemptive Change Management	Establish and execute change management strategies for each phase of analysis, design, implementation, testing and execution.
		Establish and execute change management strategies for each target of project team, client, and stakeholder.
	Collapse of Willful Blindness	Share the causes and negative results of willful blindness.
		Share the positive effects and impacts due to the collapse of willful blindness at the level of project and individual
		Introduce a specific practice mechanism for the collapse of willful blindness
Behavior Management Activities & Methods in Implementation/Testing	Principle of Consistency	Reestablish and improve the mission and plan of each participant in the implementation/testing phase. Share the details and trace the results in a visualized form
	Positive Conversation	Maintain positive thoughts, conversation, and energy within the project team.
	Self-Affirmation	Encourage self-affirmation on mission accomplishment on a regular basis
	Visualization	Promote the visualization of successful system operation, goal achievement, and compensation for the team and each individual.
	Image Training	Conduct an image training based on the system development scenario in the testing/execution phase

Dependent Variable	Category	Questionnaire Item
Project Success	Schedule/Deadline	The possibility of meeting the deadline increases.
	Cost	The probability of not exceeding the initial budget increases.
	Quality-function	The possibility of reaching a consensus on the requirements for project functions and completing the implementation of target functional requirements increases.
	Quality-non-function	The probability of reaching a consensus on the requirements for project non-functions and meeting the agreed non-functional requirements increases.
Customer Satisfaction	Process	The customer satisfaction with the progress process of the project increases.
	Result	The customer satisfaction with the result of the project implementation increases.
	Operator	The operator satisfaction with the established system increases.
	User	The user satisfaction with the established system increases.

Control Variable	Category	Questionnaire Item
Project Characteristics	Scale	How much was the overall project cost? ① Below 0.5 billion won ② Below 5 billion won ③ Below 10 billion won ④ Over 10 billion won
	Difficulty/Complexity	What was the overall difficulty of the project? (Considering the application of development methodologies, the complexity of tasks and technologies, and the purpose of the project: new/improvement/package) ① High ② Medium ③ Low