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Comparison between Decision Making Method for Success Right or Wrong of Software Development Project

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Abstract

For a purpose of improvement of project succeed. We should determine the success right or wrong of project objectively and quantitatively. And, it is necessary to reflect improvement of a failure project for a next planning of project. On the other hand, a decision of success right or wrong of software development projects has evaluated subjectively based on a questionnaire and hearing for stakeholders concerned. Furthermore, the study of definition of project success right or wrong and quantitative decision techniques are not found. Recently, gathering of the attribute data about software development projects in Japan has been performed by IPA/SEC (Software Engineering Centre of the Information-Technology Promotion Agency Japan). Therefore, we developed the diagnostic technique to decide the success right or wrong of project by a discriminant analysis based on these actual data in the precedent study. On the other hand, we tried to develop the model to estimate the "Success degree" of project in this study and made the judgment technique of decision of success right or wrong based on the defined "Success degree" of project. In this paper, we would like to propose the result of comparison between the effectiveness of these judgment techniques of the project.

Keywords: Software development, Project management, Success degree, Discriminant analysis, Diagnostic technique, Judgment techniques, Hiiting ratio.

Contribution/ Originality

The paper's primary contribution is the study of comparison between success degree estimation model and discriminant analysis in order to evaluate the effectiveness of judge technique of project success. Result of this study suggested the effectiveness of discriminant analysis to judge the success project.

1. Introduction

In the software development incorporated, "success right or wrong" of project after completion is determined by the subjective judgment based on the experience of past resemblance project or feeling of project stakeholders. However, when we judge the failed project to be success, organized improvement may not advance without PDC cycle for the success of project. On the other hand, if we can decide the reasonable failure project based on an objective judgment of "success right or wrong", we may lead an improvement for a prevention of failure of next project by the analysis of a failure project by organizations. In the precedent study, the viewpoint of management for success project (Turner and Zolin, 2012); (Atkinson, 1999) and the success factors of project are suggested (Cooke-Davies, 2002). However, in these precedent studies, definition of "success right or wrong" of project has not defined precisely, and that was the problem that the reliability of result of analysis was suspicious.

Therefore, in the previous study, we defined the concept of dynamic risk of software development project more precisely (Esaki, 2004). In late years, as a part of the national project for the purpose of the improvement of project management, collection and accumulation of the actual data (IPA/SEC, 2014) of the software development projects more than 3,000 of the Japanese domestic information service-related company, are pushed forward by IPA/SEC (incorporated administrative agency information processing promotion mechanism technology headquarters software high-reliability center). Then, we defined the concept of "Success degree" of software development project and quantified it and estimated the "Success degree" and the quantitative relations of concerning success factors (Esaki, 2014). In addition, we verified the significance of models to estimate these "Success degree" based on the result of multiple regression analysis. Also, we tried to develop the technique to judge "success right or wrong" of project based on a discriminant analysis (Esaki *et al.*, 2015). Therefore, in this paper, we propose that the

definition of “Success degree of project” and the effectiveness of judgment technique of these “success right or wrong” and the result of comparison of there. In this study, we adopted the approach of the Multiple regressions analysis based on a precedent study (Esaki *et al.*, 2000). In this paper, we propose the concept of the “success right or wrong of project” in clause 2, summary of this study in clause 3, result of comparison between the judgment techniques in clause 4 and conclusion and future prospect in clause 5.

2. Concept of Project Success

2.1. Success Right or Wrong of Project

When a fixed period of time passed after project completion, we usually perform the final judgment of “success right or wrong” of project based on the result of questionnaire survey to carry out for a customers and stakeholders of project. However, definition of "success right or wrong" to become the purpose variable as described with foregoing clause 1 is analyzed in a vague condition. Therefore, we defined “Success” based on the precedent study (Esaki, 2004); (Esaki, 2014) in precedent study. Table 1 is the correspondence of “success right or wrong” and the concept of the risk to occur newly by dynamic risk of IT investment practice described in the precedent study (Esaki, 2004). When a project result achieved an objective, we defined it as "Primary success" and when a project result satisfied the demand of final stakeholders concerned, we defined it as "Secondary success". Above considerations, we focused attention to the right or wrong of the “Primary success” from table 1 in this study.

Table-1. Definition of Success of Project IPA/SEC

A judgment of the success right or wrong based on the dynamic risk of project	**Primary failure**	**Primary success**	**Secondary failure**	**Secondary success**
Cannot achieve the goal of project planning	○	×		
Achieve the goal of project planning	×	○	—	—
The final advantage of the person concerned is not provided	—	—	○	×
The final advantage of the person concerned is provided	—	—	×	○

2.2. Judgment of Project Success

In this study, we thought that the evaluation result of "success right or wrong" that we evaluated from a viewpoint of "Quality", "Delivery", "Cost" of the project of IPA/SEC was more likely to show "success right or wrong" of project more concretely than questionnaire survey and objectively. In addition, the collection of data range is limited for time to completion from the planning stage of project. Therefore, we defined the criteria of "success right or wrong" of “Primary success” defined more precisely as show in table 2 and table 3.

2.3. Criteria of Success

The "success right or wrong” of project planning is shown in table 2. When grounds of "objective value" of the attribute about scale of projects such as “Quality”, “Delivery”, “Cost” described in planning as in table 2 and feasibility of "objective value" were clear, we judged the project planning to have "Success".

Table-2. Criteria of the Primary Success of Project Planning

Viewpoint of Success	**Judgment of the Success right or wrong of a Planning**	
	Failed	**Succeed**
Quality	Grounds of "objective value" of the attribute of scale are uncertain or there is no feasible nature non-examination or plan.	Grounds of "the targeted value" of the attribute of scale are clear and have been examined feasibility study.
Delivery		
Cost		
Synthesis	Either or all of "Quality", "Delivery" and "Cost" plans are failed.	All of "Quality", "Delivery" and "Cost" plans are succeed.

Table-3. Criteria of the result of Primary Success of Project

Success of planning		**Final Judgment of Success right or wrong of result of Project**	
		Primary failure	**Primary success**
Decision	Succeed	Either or all of "Quality", "Delivery" and "Cost" was failed.	Result of all of "Quality", "Delivery" and "Cost" was succeed.
	Failed	Impossible of Decision Making	

On the other hand, if grounds and possibility of "objective value" that was described to a plan even if plan in itself did not exist or the plan existed were unidentified, the reliability of the plan was low and judged the plan to have "Failed". The criteria of "success right or wrong" of project results as shown in table 3. In this study, the project planning was "Failed" and did not judge the project results to be "Primary failure" from criteria of table 2 even if "execution value" of the attribute of scale exceeded "objective value".

On the other hand, we did not judge it to have necessarily "Primary Success" even if "execution value" achieved "objective value" when "objective value" was defined more highly than an achievable value. Therefore, in this study, we thought that the judgment of "success right or wrong" of project results was "impossible" regardless of "objective value" and bigger or smaller of "execution value" by project that the planning "failed" in table 3. In this study, under the premise that project plan "succeeded" from

criteria of table 2, when "execution value" of scale of QCD (“Quality”, “Delivery”, “Cost”) of the project was equal to "objective value" or near, we judged it to be "Primary Success" in table 3. Next, we determined that we "failed" not to be able to achieve an aim when "execution value" exceeded "objective value". On the contrary, we thought and judged it to have been able to achieve the result that was higher than a sign as a result of effort and inventive idea of the project member when "execution value" was less than "objective value" with "Excellence".

Furthermore, we judged the general "success right or wrong" to have “Primary Success" when all the results of "QCD" made "Primary Success". Next, we judge the case that either of results of "QCD" "Primary failure" in to be "Primary failure". When all of results of "QCD" included "Primary success" or "Excellence" and "Excellence" more than one, we judged it to be “Excellent" generally.

2.4. Quantification Standard of Success Degree

In this study, we introduced the quantitative index of "Success degree" about the execution of “self-evaluation” of "success right or wrong" of IPA/SEC. The quantification standard to define the “Success degree” of “success right or wrong” of each plan and results of "QCD" of IPA/SEC is shown in table 4. When degree of "Failure" was big, the "Success degree" defined the lower value based on the quality of result of the “self-evaluation” based on the criteria of "success right or wrong" of foregoing paragraph, table 2 and table 3.

For the description of the evaluation result about "success right or wrong" of each planning of "QCD" of the plan defined big value so as to possess high reliability, and defined “Success degree” as +1.0 as "Success" from 0.0 as "Failure". Similarly, we defined from 0.0 (failure) to 1.0 (success) as "Success degree" for the description of evaluation of the result of execution about “success right or wrong” of "self-evaluation".

Table-4. Quantification Standard of Success Degree of Project

An evaluation of success right or wrong of Planning				**An evaluation of success right or wrong of Execution**	
121_Quality	**122_Delivery**	**120_Cost**	**Decision**	**116d_Self-evaluation**	**Decision**
The quality goal is clear and has been examined feasibility study.(Success degree = 1.0)	Grounds of the delivery goal are clear and have been examined feasibility study. (Success degree = 1.0)	Calculation grounds of the cost goal are clear and have been examined feasibility study. (Success degree = 1.0)	Succeed	All QCD Success（Success degree = 1.0）	Primary Success
				Two succeed among QCD(Success degree = 0.6)	Primary failure
				Only one succeeds among QCD(Success degree = 0.2)	
				Success is 0 among QCD(Success degree = 0.0)	
The quality goal is uncertain or feasibility study is non-examination. (Success degree = 0.0)	The grounds of the delivery goal are uncertain or feasibility study is non-examination. (Success degree = 0.0)	Calculation grounds of the cost goal are uncertain or feasibility study is non-examination. (Success degree = 0.0)	Failed	---------	Impossible Decision Making
No planning（Success degree = 0.0）					

2.5. Judgment of Success based on the Success Degree

When "121_quality of plan", "122_ delivery time of plan", "120_ cost of plan" of "Success degree" that we defined based on table 4 overcame all +1.0 and "Success degree" of "116d_self-evaluation of project" were more than 0.6, we judged the project with “1: Primary Success". When the "Success degree" was smaller than 0.6, we judged the project with “0: Primary failure".

3. Summary

In this study, we adopted the approach that estimate the success from actual data provided at the project completion based on the concept of frame work of " planning - execution - evaluation " of project management to judge the “success right or wrong” of project. We thought it to have possibilities to be available for the judgment of “success right or wrong” at the project completion stage if we could identify the attribute of execution of project to be related to "success right or wrong".

Therefore, we extracted the project that the attribute data were described and the qualitative evaluation result of QCD of project “Success degree” to show in table 4 was described from attribute data (IPA/SEC, 2014) of IPA/SEC for identification of project attribute to be related to the success of the project. We quantified it based on the sbjective description of “success right or wrong” of the planning of "QCD" and execution of "self-evaluation" in table 4. We performed identification 0 as “Primary failure” and 1 as “Primary success” of “success right or wrong” based on this result. In addition, all the plans of "QCD" extracted a successful project to judge the “success right or wrong” based on the "Success degree".

Next, as for the “Success degree” of "self-evaluation" to perform the discriminant analysis, the “Primary failure” defined to -0.5 and “Primary Success” defined to +0.5. Next, we performed the correlation analysis between "Success degree" of project and the attribute data about scales. We identified the “success right or wrong” and the strong project attribute of correlation to shown in table 5. Furthermore, we performed the "discriminant analysis" by using "Success degree prediction model" to

judge it from the results of attribute data which identified "success right or wrong" of project. We inspected the effectiveness of the model to estimate project "success right or wrong" as shown in table 6. In addition, we applied the "Success degree estimation model" to actual projects that there are not deletion data in 14 explanation variables except 27 projects that we used for the development of estimation model and judged "success right or wrong".

Furthermore, we evaluated the comparison between the result of judgment of "success right or wrong" and hitting ratio and the comparison inspected the superiority and inferiority of the technique to judge the "success right or wrong" as shown in table 7.

3.1. Targeted Data for Analysis

Attribute data were based on the software development method based on a waterfall model, and there were the 3325 projects that were collected from 2004 to 2014, and as for the number of attribute item data were 611. But attribute item data is not necessarily being filled out and the loss of data were recognzed.

Therefore, in this study, we extracted the only reliable data of project that there was not loss for necessary attribute data and its reliability was admitted and level of "Success degree" of planning and execution of project was provided based on the quantification standard of "Success degree" of table 4, and "number of personnel of average" extracted projects more than 3 people, for the development of model to estimate success of the project at project completion stage.

At first, the plan and results of qualitative "Success degree" of "Quality", "Delivery" and "Cost" of project as shown in table 4 extracted 1,650 project data filled out. Next, basic attribute data which is related to "success right or wrong" of project that became clear in the "self-evaluation" result of project and precedent study did not have data loss. And the attribute data by which scale of "number of personnel of average" is more than 3 personnel was picked out. Finally, the consistency between attribute data was recognized and extracted the project targeted for 41 analyses that determined by secretariat of IPA/SEC possessed high reliability (A).

3.2. Estimation of Success

In this study, we formulated the multiple regression models which assumes attribute which is correlated with the "success right or wrong" of project that we identified in table 6 explanation variables by the equation (1) to estimate the "success right or wrong" of project from the attribute of project and verified the effectiveness of model.

$$y_i = r_0 + r_1 a_i + r_2 b_i - - - - - - - - - - r_6 l_i \qquad (1)$$

$\boldsymbol{y_i}$:An estimate value of the project success

$\boldsymbol{r_n}$: Partial regression coefficient ($n = 0 \sim 6$)

i : The sample number of the project ($i = 1 \sim N$, $N=42$)

Furthermore, based on the expression (2), we confirmed the hitting ratio of judgement result: HR_i from the actual result of execution of "success right or wrong" and estimated result which calculated from the estimation model of "success right or wrong" of project as shown in table 4.

$$HR_i = 1 - \left(\sum_{i=1}^{N} \sqrt{(y_i - Y_i)^2} \right) / N \qquad (2)$$

$\boldsymbol{HR_i}$: Hitting ratio of "success right or wrong" of judgement result

$\boldsymbol{Y_i}$: Actual value of the project success

3.3. Procedure of Analysis

[Step 1] We performed the correlation analysis of "success right or wrong" of "self-evaluation of execution" and attribute to be connected with success of project included in the attribute data of 611 items of IPA/SEC. We identified the project "success right or wrong" as shown in table 5 and strong plural attributes of the correlation.

[Step 2] We assumed the attribute that we identified with Step 1 an explanation variable. Based on the equation (1), we developed the plural multiple regression models to assume the "self-evaluation" results of the "success right or wrong" for purpose variable.

[Step 3] We confirmed the significance of the estimation model to estimate the "Success degree" based on the result of multiple regression analysis as shown in table 6.

[Step 4] We applied the results level of project attribute data to the model to estimate "Success degree" that we developed with Step 2 and demand the judgement result of "success right or wrong" as shown in table 7. And based on the equation (2), we confirmed the hitting ratio of "success right or wrong" from judgement technique and the actual results of "success right or wrong". We compared the significance of judgment technique to judge "success right or wrong" and inspected its.

4. Verification of the Judgment Technique

4.1. Correlation Analysis of Success and Attribute Concerned

Table 5 gathered up the attribute of project that "success right or wrong" and particularly strong correlation was recognized and other basics attributes.

Strong negative correlation was recognized between "116d2_self-evaluation of project by discriminant analysis" and "success right or wrong" of "116d_self-evaluation of project" and "5523_Number of average of personnel",

Table-5. Result of correlation analysis among Attributes of Project and Project Success

Attribute of the project	Success right or wrong (self-evaluation)	
	Discriminant analysis	Actual Result
	116d2	116d
5223_Number of average of personnel	-0.3584	-0.4269
5232_Number of personnel of peak	-0.3167	-0.4126
10059_Number of average of outside order personnel	-0.1104	-0.1636
10050_Performance man-hour total	-0.2145	-0.2882
10052_Performance man-hour Requirement definition	-0.1207	-0.1447
10053_Performance man-hour Basic design	-0.1514	-0.1556
10054_Performance man-hour_ Detailed definition	-0.1232	-0.1963
10055_Performance man-hour Production	-0.1780	-0.2622
5195h_Outside order performance man-hour total	0.0430	0.0520
10015h_Performance man-hour inner office total	-0.2761	-0.3677
5185nh_Performance man-hour management total	-0.1380	-0.2443
10077m=10077_Number of Review indication/10050_Performance man hour total	-0.2864	-0.3262
10079m=10079_Number of Review indication _requirement definition/10050_Performance man hour total	-0.1364	-0.1825
10077_Number of Review indication	-0.1767	-0.2015
10079_Number of Review indication Requirement definition	-0.0924	-0.1413
5257m=5257_Number of outbreak deficient serious (6months) /10050_Performance man hour total	-0.0385	-0.0882
5257_Number of outbreak deficient serious (6months)	-0.3173	-0.4472
5261_Number of outbreak deficient medium(6months)	-0.1814	-0.3164
5269_Number of outbreak deficient total(6months)	-0.1416	-0.2844
11015h_Planned value of Development man-hour (at basic design start)	-0.1447	-0.1984

"10050_Performance man-hour total" , "10015h_Performance man-hour inner office total" ,"10079m_review indication number / man-hour total", "5257_Number of outbreak deficient serious (6months)", "5261_ Number of outbreak deficient medium(6months) ,"5269_Number of outbreak deficient total(6months)" by table 5. Therefore, we can confirm that the "Success degree" of project decreases as value of these attributes data is big. In addition, the "success right or wrong" of project has need to pay attention to these attribute data.

4.2. Verification of Success Degree Estimation Model

We show the result of the multiple regression analysis of the model that we developed to judge the project "Success degree" in table 6. According to table 6, the result of multiple regression analysis of model to estimate the "Success degree" of "116d2p_self-evaluation estimated by Discriminant analysis", the multiple correlation coefficient is 0.6426 and the decision coefficient is 0.4130, F-number is 3.8693 (F_0=2.7426, m=4), P-number is 0.0158. Therefore, as for the discriminant analysis model, significance of 5% is recognized. On the other hand, the result of multiple regression analysis of model to estimate the "Success degree" of "116d1p_self-evaluation estimated by normal prediction", the multiple correlation coefficient is 0.7976 and decision coefficient is 0.6361, F-number is 9.6146 (F_0=4.1400, m=4), P-number is 0.0001. Therefore, as for the normal estimation model, significance of 1% is recognized.

Table-6. Result of Multiple regressions analysis among concerning Attributes of Project Success

The attribute of the explanation variable	Coefficient	Project success or failure (self-evaluation)	
		116d2p	116d1p
Constant term	-	0.3833	0.9994
10053_Performance man-hour basic design	r_1	-0.0002	
5185_Performance man-hour management	r_2	0.0003	
10077_ Review indication number	r_3	-2.0458	-2.8108
5257_ Number of outbreak deficient phenomena serious (6months)	r_4		-0.0844
5261_ Number of outbreak deficient phenomena medium (6months)	r_5		0.0254
5269_ Number of outbreak deficient phenomena total (6months)	r_6	-0.0120	-0.0278
R:Multiple correlation coefficient		0.6426	0.7976
R^2 : Decision coefficient		0.4130	0.6361
F-number		3.8693	9.6146
P-number		0.0158	0.0001
$F_0(m_1, 26, 0.01)$		4.1400	4.1400
$F_0(m_1, 26, 0.05)$		2.7426	2.7426
m_1=		4	4

4.3. Comparison of Judgment Technique and Consideration

The result of estimated value of "success right or wrong" of project that we estimated by discriminant analysis and the "Success degree" estimate model and hitting ratio is shown in table 7. According to table 7, if estimated value of the "success right or wrong" is bigger than 0, we assume it (success: 1), and if its value is less than 0, we assume it (failure: 0). The hitting ratio of "success right or

wrong" that we applied the expression (2) to judgement result of "success right or wrong" that we confirmed in this way and the judgement result of "success right or wrong" and found became 86%. And we can confirm that the effectiveness is high by the judgement result of "success right or wrong". On the other hand, if the estimated value of "Success degree" of "116d1p_self-evaluation" is bigger than 0.6, we assumed it (success: 1), and if its value is less than 0.6, we assumed it (failure: 1). The hitting ratio of "success right or wrong" that we judged in this way became 57%, and hitting ratio of "success right or wrong" was confirmed lower than the result of discriminant analysis. It is thought that the higher in hitting ratio of "success right or wrong", the "using discriminant analysis" is higher than "Success degree prediction model" because we defined the "Success degree" of purpose variable from -0.5 to +0.5 in order to clear significant difference.

Table-7. Comparison between Result of Estimation of Project Success and Hitting ratio

			Discriminant analysis decision model			**Success degree decision model**		
S_i	Actual Value		Estimated value	Success or failure	Difference	Estimated value	Success or failure	Difference
No	116d		116d2p	116d2p > 0 = 1		116d1p	116d1p > 0.6 = 1	
3	0.20	0	-1.387	0	0	0.268	0	0
6	0.20	0	-0.789	0	0	-0.187	0	0
9	0.60	0	-0.048	0	0	0.770	1	1
12	0.60	0	-0.326	0	0	0.797	1	1
15	0.60	0	0.040	1	1	0.867	1	1
18	1.00	1	0.456	1	0	0.804	1	0
21	1.00	1	-2.270	0	1	0.174	0	1
24	1.00	1	0.340	1	0	0.978	1	0
27	1.00	1	0.242	1	0	0.970	1	0
30	1.00	1	0.172	1	0	0.826	1	0
33	1.00	1	0.555	1	0	0.916	1	0
36	1.00	1	0.092	1	0	0.694	1	0
39	1.00	1	0.100	1	0	0.539	0	1
42	1.00	1	0.111	1	0	0.598	0	1
Total					2			6
Hitting ratio			0.86			0.57		

5. Concluding Remarks

In this study, we tried to compare the technique to enable the judgment of quantitative "success right or wrong" between the "discriminant analysis" and "Success degree prediction model" from the actual attribute data of project. From the result of this study, in the diagnosis of “success right or wrong” at the completion of project, we confirmed that the method by the discriminant analysis was higher in significance than the decision method based on the “Success degree” prediction model. On the other hand, by the estimated value of “Success degree”, we confirmed the effectiveness of estimated technique based on the “Success degree” prediction model. As the future issue, we would like to try improvement of judgment precision of “success right or wrong” of project that we suggested in this paper, and development of the technique to predict “success right or wrong” of project from a design stage of project as early as possible.

References

Atkinson, R., 1999. Project management: Cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. International Journal of Project Management 17(6): 337-342.

Cooke-Davies, T., 2002. The real success factors on project. International Journal of Project Management, 20(3): 185-190.

Esaki, K., 2004. Total risk management for IT investment from the view point of top management. Journal of Society of Project Management, 6(4): 9-14.

Esaki, K., 2014. Study of influential factors for quality of information system development project, information processing of Janan. IPSJSIG Technical Report, 2014-IS-129(1):1-8.

Esaki, K., K. Kuwahara and T. Sagae, 2015. Development of decision making method to success of software development project based on the discriminant analysis. 3rd International Confrence Processing of Tairand, ICEFMO Technical Report, 20(10):10-10.

Esaki, K., S. Yamada, M. Takahashi and K. Hihara, 2000. A quality engineering approach to human faders afreding software reliabmty in design process, the transactions of the institute of electronics. Information and Communication, J83-A(7): 875-882.

IPA/SEC, 2014. Software engineering center of the information-technology promotion agency Japan, software high-reliability center: IPA/SEC White Paper 2014 on Software Development Project in Japan.

Turner, R. and R. Zolin, 2012. Forcasting success on large projects: Developing reliable scales to predict multiple perspectives by multiple stakeholders over multiple time frames. Project Management Journal, 43(5): 87-99.