

Relationships Between Organizational Integration and Project Performance for Construction Projects

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Abstract: The organizational integration aiming at overall optimization and function multiplication has been applied to the practices of construction projects which has been proven to an effective way to solve complex problem. But seldom study the relationships of project organizational integration and project performance in construction industry. Based on literature review, organizational integration of construction projects was described by four key facets-shared value, organizational relationship, organizational structure and organizational ability and project performance was expressed multi-dimensions as process performance, quality performance, innovation and learning performance and stakeholder performance. Then the relationships between organizational integration and project performance were empirical analyzed using SPSS 15.0. The results show that: Shared value, organizational relationship, organizational structure and organizational ability have the significant positive effect on process performance, quality performance, innovation and learning performance; shared value, organizational relationship, organizational structure have the significant positive effect on stakeholder performance. The research can provide some practical guidance for the managers in construction projects to improve project performance through organizational integration.

Key words: Construction projects, organizational integration, project performance, relationships

INTRODUCTION

According to a forecast report about global construction market in 2009, China will become the largest construction market surpassing the United States in 2018. But at the same time, most selected Chinese construction enterprises going lower at the United States "Engineering News Record" top 225 international contractor rankings. Competition of Chinese construction enterprises mainly rely on low cost, lacking of comprehensive ability of effective management. Therefore, how to improve project performance is one of the main problems of China's construction enterprises with the rapid development. In the changeable environment of engineering projects, the project organizational integration has become an important way to improve project performance.

Some scholars have done research on the relationships between organizational integration and project performance in manufacturing industry and found that organizational integration can cut down cost, increase revenue and improve efficiency (Pinsonneault and Kraemer, 2002). But seldom study the

relationships of project organizational integration and project performance in construction industry. Therefore, the questionnaire survey was adopted to analyze the relationships between organizational integration and project performance. The research can enrich the theory of organizational integration and project performance and provide some practical guidance for the managers in construction projects to improve project performance through organizational integration.

THEORETICAL HYPOTHESIS

Framework of organizational integration: The concept of organizational integration can be traced back to the earliest cooperation and coordination of Fayol (1949). Project organizational integration refers to integrate the different organizational factors in the engineering activities (such as organizational unit, subsystem) to become an organic organization. In this state, all the organizational elements are combined together by the reasonable structure, to make the organizational behavior more harmonious and orderly and obtain the function multiplier effect.

The research on project organizational integration started from integrated organization form in manufacturing, such as dynamic manufacturing alliance, strategic alliance, agile manufacturing, manufacturing team, fractal manufacturing (Yusuf *et al.*, 1999). According to the drawbacks of traditional construction projects-"fragments", "phase separation", some organizational integration model were put forward (Mitropoulos and Tatum, 2000), including concurrent design and construction integration, multidisciplinary team, dynamic united organization and virtual organization (Baiden *et al.*, 2006; Qi and Zhang, 2011). After having a literature review on the factors of project organizational integration, project organizational integration can be described 4 key frames: Shared value, organizational relationship, organizational structure and organizational ability. The four elements are influenced by each other and form the state of organizational integration.

Shared value: The shared value refers to all employees of organization sharing the common beliefs, values, goals abiding by a series of behavior which give organization support to complete a task and provide inexhaustible motivation to achieve the vision. Shared value is the core and foundation of organizational integration.

Organizational relationship: Organizational relationship refers to the rules and mechanisms of various elements within or between organizations. The organizational relationship has an important effect on overall optimization and function multiplier of organizational integration. A good relationship can make up for defects of team ability and organizational structure while bad organizational relationship tend to offset the advantages of team ability and organizational structure, make organizational integration cannot achieve the desired effect.

Organizational structure: Organizational structure is the framework of the whole organization system and the foundation of organizational ability. Integrated organization with the united leadership, multiple dimensions of organizational elements, has the characteristics of flexible, lean, fuzzy, dynamic and functional multiplication.

Organizational ability: Organizational ability is the ability of organizational members combining with its organizational resources and creating the right environment to reach its strategic target. Pinto and Slevin

pointed that, organizational ability is an important factor for successful projects. Organizational ability is essential for organizational integration to enhance project efficiency, because the quality and ability of organizational members ensure the formation of organizational integration.

Measures of construction project performance:

Measurement of project performance not only includes the traditional iron triangle-time, quality, cost but also should take other aspects into consideration, such as the tactical and strategic goals, social psychology, future and development, etc. The study measured comprehensively from four dimensions of project performance, including process performance, quality performance, innovation and learning performance and stakeholder performance.

Process performance: The traditional iron triangle reflects the efficiency of the project, so they are taken into consideration. At the same time, the dimension also add other process parameters reflecting the operation efficiency and management efficiency, such as plan of safety, quality management, change and response capability, environmental protection and risk management, etc.

Quality performance: Engineering quality is related to the project investment benefit, social benefit and environmental benefit. Its problems will endanger the safety of lives and property and influence the development of the national economy. Previous study shows that in the construction projects, the realization degree of quality objectives is pretty important to measure project performance. As a successful external measurement index, quality can be measured by technical specifications, customer focus and etc. (Tukel and Rom, 1998).

Innovation and learning performance: Innovation and learning can increase knowledge reservation of stakeholders to help the organization to meet the challenges better. Dimensions include improving human capital of stakeholders (excellent professional technical ability, leadership, management ability, level of training and integration, improvement of project process), improving information system (continuous improvement of information management system and database system, identification of best practices and experience) and enhancing project culture (strategic cognition, enterprise culture, employee empowerment, effective incentive and team consciousness) (Nelson, 2005).

Stakeholder performance: The needs of stakeholders determine the performance, so the satisfaction of stakeholders on performance decides the realization degree of all project performance. In construction projects, the key stakeholders includes the owners, contractors and supervisors (DeLone and McLean, 2003; Wang and Huang, 2006). The goals of project stakeholders should include the satisfaction of users and project teams, personal development and learning and impact to the surrounding community economic; in addition, the realization degree of key participants, appreciation and complaints about cooperators should be taken into consideration.

To sum up, the process performance, quality performance, innovation and learning performance and stakeholder performance are four related but different dimensions and innovation and learning performance provides the basis for other three aspects.

Hypothesis of relationships between project organizational integration and project performance: The study proposed the project organizational integration including four key parts-shared value, organizational relationship, organizational structure and organizational ability which is necessary for projects to reach the organizational integration state. Some research has shown that manufacturing organizational integration is conducive to improve the performance (Truman, 2000; Mukhopadhyay and Kekre, 2002). So supposing that in the construction industry, organizational integration has a positive effect on project performance and puts forward the following hypothesis:

- Hypothesis 1:** Project organizational integration has a positive effect on process performance. Specifically
- Hypothesis 1a:** Shared value has a positive effect on process performance
- Hypothesis 1b:** Organizational relationship has a positive effect on process performance
- Hypothesis 1c:** Organizational structure has a positive effect on process performance
- Hypothesis 1d:** Organizational ability has a positive effect on process performance
- Hypothesis 2:** Project organizational integration has a positive effect on quality performance. Specifically
- Hypothesis 2a:** Shared value has a positive effect on quality performance
- Hypothesis 2b:** Organizational relationship has a positive effect on quality performance

- Hypothesis 2c:** Organizational structure has a positive effect on quality performance
- Hypothesis 2d:** Organizational ability has a positive effect on quality performance
- Hypothesis 3:** Project organizational integration has a positive effect on innovation and learning performance. Specifically
- Hypothesis 3a:** Shared value has a positive effect on innovation and learning performance
- Hypothesis 3b:** Organizational relationship has a positive effect on innovation and learning performance
- Hypothesis 3c:** Organizational structure has a positive effect on innovation and learning performance
- Hypothesis 3d:** Organizational ability has a positive effect on innovation and learning performance
- Hypothesis 4:** Project organizational integration has a positive effect on stakeholder performance. Specifically
- Hypothesis 4a:** Shared value has a positive effect on stakeholder performance
- Hypothesis 4b:** Organizational relationship has a positive effect on stakeholder performance
- Hypothesis 4c:** Organizational structure has a positive effect on stakeholder performance
- Hypothesis 4d:** Organizational ability has a positive impact on stakeholder performance

QUESTIONNAIRE DESIGN

Data collection: Likert scale was taken to measure the attitude of respondents about the relationships between organizational integration and project performance for construction projects. Firstly, 10 construction project managers or senior engineers were chosen to preliminary test about the reasonableness and accuracy of the questionnaire. Then 410 letters and emails of formal questionnaire were sent to the construction industry practitioners (mainly project executives and engineers) and 256 questionnaires were recovered, the recovery rate was 62.4%, of which 204 valid questionnaires. From the descriptive statistics of sample, the sample contains different seniority, different units, different positions of the construction industry, all ensure the reliability.

Measure variables: Construction engineering projects as the research object, through literature review, the measurement variables of project organizational integration and project performance were identified for data acquisition (Table 1).

Table 1: Measurement of engineering project organizational integration and project performance

Variables	First-class index	Second-class index
Organizational integration	Shared value	Win-win cooperation; core value; team spirit; global concept; host responsibility
	Organizational relationship	Division of authority and responsibility; benefit distribution; risk allocation; object management; planning system; project coordination; communication mechanism
	Organizational structure	Joint leadership; flexibility; lean; dynamic; function multiplication
	Organizational ability	Coordination ability of interpersonal relationship; coordination ability of information exchange; coordination ability of overall goal and members; coordination ability of difference; adaptability to environmental change; ability of combining and reshaping organizational competition
Project performance	Process performance	Time limit; cost; change in the implementation
	Quality performance	Quality defect; excellent and good rate of unit project; satisfaction rate of technical specifications and requirements
	Innovation and learning performance	Technology breakthrough and innovation; sustainable development and change; best practices; increased knowledge and experience; increased cooperation willing
	stakeholder performance	Gotten admiration; implementation of commitments; complaint rate; mutual litigation claims

RESULTS ANALYSIS

Reliability and validity analysis: Cronbach's alpha coefficient and the correlation coefficient CITC were used to do reliability analysis. The result shows the Cronbach's α of all variables are greater than 0.7 and the CITC values are above 0.5, so the measurement index has high internal consistency.

Factor analysis method was used to validity analysis and KMO Bartlett ball test to verify the independency of variables. The result of validity analysis shows that the KMO value of all the variables were above 0.7 and the factor loadings are more ideal which shows the variables have high internal consistency and reliability.

Correlation analysis: Pearson correlation analysis was used to calculate the correlation coefficient of project organizational integration and project performance. The result of correlation analysis is as shown in Table 2.

It is seen from Table 2, except that the correlation between organizational ability and stakeholder performance did not reach significant level, there have a significant positive correlation between other dimensions of project organizational integration and project performance. Therefore, it referred preliminarily that project organizational integration is beneficial to improve project performance. In addition, the results also show there has significant correlation among each dimensions of project organizational integration which indicates that the dimensions of project organizational integration interact with each other and they may jointly play a positive role in improving project performance.

Multiple regression analysis: Multiple regression analysis was used to test the hypothesis of the relationships between project organizational integration

and project performance. In the multiple regression analysis, shared value, organizational relationship, organizational structure and organizational ability are independent variables, project process performance, quality performance, innovation and learning performance, stakeholder performance are dependent variables and the result as shown in Table 3.

It can be seen from Table 3, except the significance level of F value of stakeholder performance is slightly higher than 0.05, others' significance level of F value are less than 0.05 which means that there are linear relationships between the independent variables and dependent variables; VIF value are in the range of 1.0 to 2.5 which means that there was no multicollinearity; The highest value of Durbin-Watson test is the project organizational integration to process performance, is 2.145 and the other value of Durbin-Watson are close to or less than 2 which means residual and independent variables are independent of each other, so the study is meaningful.

Through the above regression analysis, among the 20 theoretical hypothesis proposed that project organizational integration to project performance, 18 received support and 1 received partial support, as shown in Table 4.

The multivariate analysis results show that there have significant positive effect of shared value, organizational relationship, organizational structure and organizational ability on improve process performance, quality performance, innovation and learning performance; shared value, organizational relationship and organizational ability have significant positive effect on stakeholder performance. Thus it can be seen, shared value, organizational relationship and organizational ability are the common factors affecting all dimensions of performance and not every dimension of organizational integration has effect on each dimension of performance, for example, the effect of organizational structure on stakeholder performance is not significant.

Table 2: Correlation analysis of variables

Variables	Shared value	Organizational relationship	Organizational structure	Organizational ability	Process performance	Quality performance	Innovation and learning performance	Stakeholder performance
Shared value								
Pearson	1.000	0.735**	0.475**	0.577**	0.364**	0.368**	0.460**	0.292**
Sig. (1-tailed)		0.000	0.000	0.000	0.001	0.001	0.000	0.008
Organizational relationship								
Pearson	0.735**	1.000	0.414**	0.633**	0.445**	0.484**	0.350**	0.315**
Sig. (1-tailed)	0.000		0.000	0.000	0.000	0.000	0.002	0.004
Organizational structure								
Pearson	0.475**	0.414**	1.000	0.538**	0.444**	0.272*	0.246*	0.256*
Sig. (1-tailed)	0.000	0.000		0.000	0.000	0.012	0.022	0.018
Organizational ability								
Pearson	0.577**	0.633**	0.538**	1.000	0.407**	0.490**	0.422**	0.183
Sig. (1-tailed)	0.000	0.000	0.000		0.000	0.000	0.000	0.068
Process performance								
Pearson	0.364**	0.445**	0.444**	0.407**	1.000	0.171	0.044	0.231*
Sig. (1-tailed)	0.001	0.000	0.000	0.000		0.082	0.362	0.029
Quality performance								
Pearson	0.368**	0.484**	0.272*	0.490**	0.171	1.000	0.510**	0.428**
Sig. (1-tailed)	0.001	0.000	0.012	0.000	0.082		0.000	0.000
Innovation and Learning performance								
Pearson	0.460**	0.350**	0.246*	0.422**	0.044	0.510**	1.000	0.391**
Sig. (1-tailed)	0.000	0.002	0.022	0.000	0.362	0.000		0.000
Stakeholder performance								
Pearson	0.292**	0.315**	0.256*	0.183	0.231*	0.428**	0.391**	1.000
Sig. (1-tailed)	0.008	0.004	0.018	0.068	0.029	0.000	0.000	

N = 204; **significant under the level of 0.01; * represent significant under the level of 0.05

Table 3: Multiple regression analysis of project organizational integration to project performance

	R	R square	Adjusted R square	F change	Sig. F change	Durbin-Watson	Standardized coefficient of shared value	Standardized coefficient of organizational relationship	Standardized coefficient of organizational structure	Standardized coefficient of organizational ability
Project performance										
Process performance	0.532	0.283	0.238	6.218	0.000	2.145	0.480	0.305	0.296	0.083
Quality performance	0.540	0.292	0.247	6.486	0.000	2.023	0.047	0.320	0.010	0.320
Innovation and learning performance	0.504	0.254	0.207	5.364	0.001	1.824	0.392	0.097	0.055	0.287
Stakeholder performance	0.459	0.129	0.074	2.336	0.055	1.947	0.098	0.251	-0.173	-0.126

Table 4: Hypothesis testing results of project organizational integration to project performance

Hypothesis	Testing result	Hypothesis	Testing result
Hypothesis 1: Project organizational integration-process performance	Supportive	Hypothesis 3: Project organizational integration-innovation and learning performance	Supportive
Hypothesis 1a: Shared value-process performance	Supportive	Hypothesis 3a: Shared value-innovation and learning performance	Supportive
Hypothesis 1b: Organizational relationship-process performance	Supportive	Hypothesis 3b: Organizational relationship-innovation and learning performance	Supportive
Hypothesis 1c: Organizational structure-process performance	Supportive	Hypothesis 3c: Organizational structure-innovation and learning performance	Supportive
Hypothesis 1d: Organizational ability-process performance	Supportive	Hypothesis 3d: Organizational ability-innovation and learning performance	Supportive
Hypothesis 2: Project organizational integration-quality performance	Supportive	Hypothesis 4: Project organizational integration-stakeholder performance	Partly supportive
Hypothesis 2a: Shared value-quality performance	Supportive	Hypothesis 4a: Shared value-stakeholder performance	Supportive
Hypothesis 2b: Organizational relationship-quality performance	Supportive	Hypothesis 4b: Organizational relationship-stakeholder performance	Supportive
Hypothesis 2c: Organizational structure-quality performance	Supportive	Hypothesis 4c: Organizational structure-stakeholder performance	Unsupportive
Hypothesis 2d: Organizational ability-quality performance	Supportive	Hypothesis 4d: Organizational ability-stakeholder performance	Supportive

CONCLUSION

Based on literature study and theoretical analysis, organizational integration of construction projects was described by four key facets-shared value, organizational relationship, organizational structure and organizational ability and project performance was expressed multi-dimensions as process performance, quality performance, innovation and learning performance and stakeholder performance. Then the relationships between organizational integration and project performance were empirically analyzed using SPSS 15.0. The results show that, there have significant positive effect of shared value, organizational relationship, organizational structure and organizational ability to process performance, quality performance, innovation and learning performance; shared value, organizational relationship and organizational ability have positive significant effect on stakeholder performance. Thus it can be seen, shared value, organizational relationship and organizational ability are the common factors affecting all dimensions of performance and not every dimension of organizational integration has effect on each dimension of performance, such as the effect of organizational structure on stakeholder performance is not significant. The results provide the theoretical basis for further study on the relationships between organizational integration and project performance and provide some practical guidance for the managers in construction projects to improve project performance through organizational integration.

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REFERENCES

- Baiden, B.K., A.D.F. Price and A.R.J. Dainty, 2006. The extent of team integration within construction projects. *Int. J. Project Manage.*, 24: 13-23.
- DeLone, W.D. and E.R. McLean, 2003. The De Lone and McLean model of information systems success: A ten-year update. *J. Manage. Inform. Syst.*, 19: 9-30.
- Mitropoulos, P. and C. Tatum, 2000. Management-driven integration. *J. Manage. Eng.*, 16: 48-58.
- Mukhopadhyay, T. and S. Kekre, 2002. Strategic and operational benefits of electronic integration in B2B procurement processes. *Manage. Sci.*, 48: 1301-1313.
- Nelson, R.R., 2005. Project retrospectives: Evaluating project success, failure and everything in between. *MIS Q. Executive*, 4: 361-372.
- Pinsonneault, A. and K.L. Kraemer, 2002. Exploring the role of information technology in organizational downsizing: A tale of two American cities. *Organiz. Sci.*, 13: 191-208.
- Qi, A.B. and W. Zhang, 2011. Network organizational integration of large construction projects: Influencing factors, model and method. *Project Manage. Technol.*, 2: 18-18.
- Truman, G.E., 2000. Integration in electronic exchange environments. *Manage. Inform. Syst.*, 17: 209-244.
- Tukel, O.I. and W.O. Rom, 1998. Analysis of the characteristics of projects in diverse industries. *J. Oper. Manage.*, 16: 43-61.
- Wang, X.J. and J. Huang, 2006. The relationships between key stakeholders' project performance and project success: Perceptions of Chinese construction supervising engineers. *Int. J. Project Manage.*, 24: 253-260.
- Yusuf, Y.Y., M. Sarhadi and A. Gunasekaran, 1999. Agile manufacturing: The drivers, concepts and attributes. *Int. J. Prod. Econ.*, 62: 33-43.