The Association between Project Management Knowledge Areas and Sustainable Outcomes in Urban Construction Projects

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Abstract
The sustainable urban development is a critical component of urban planning, aiming to improve the urban development efficiency, increase quality of life, protect the ecological environment of the city and realize the sustainable utilization of urban resources. As part of the strategy for sustainable urbanization, several urban construction projects has been implemented in some cities of Iran for years. To evaluate the effectiveness and reveal the future direction of development of these projects, it is essential to analyze their management structure in the framework of sustainable development. This paper investigated the relation between project management knowledge areas (PMKA) and the expected sustainable outcomes of the projects from four urban construction projects in Tabriz, Iran. Through a quantitative research method including data analysis using Chi-square and Cramer's V association, different sorts of link between 10 PMKA and 11 expected sustainable outcomes of the urban construction projects were revealed and discussed.

Keywords: Management, Project, Sustainability, Urbanization.

1. Introduction

Nowadays, both citizens and decision makers and planners face a contradictory situation, since, although they have technological instruments to ameliorate their daily lives, still, the economic crisis restricts the introduction and absorption of such instruments to sustainable management. It is clear that cities need to identify new strategies in order to improve quality of life of citizens, adjusting their planning to economic competitiveness and market needs, but also to emerging consuming behavior and trends. Statistics are revealing and actions, initiatives and sustainable solutions and approaches are required (Nathanail et al., 2017). Many cities in Iran have implemented the sustainable urbanization policies and accumulated much experience these decades. Most part of these key policies, which are performed as the policies of intensive use, waste management, low carbon emissions, environmental governance on construction activities and economic development of the urban land are related to urban construction projects.
There is little literature highlighted the relationship of sustainable project management and sustainable urbanization even they are closely linked. Most of the previous literature have revealed the urban problems caused by unsustainable land use (Ashraf & Yasushi, 2009).

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Generally, this paper was intended to evaluate sustainable urbanization from the completely new perspective regarding sustainable construction management. Based on the above-mentioned idea, this paper tried to test the effectiveness of sustainable project management policies through evaluating the quantitative correlation between sustainable urbanization and sustainable project management in selected urban construction projects in Tabriz, Iran.

2. Research Methodology

This empirical research employed a questionnaire survey to obtain data from the four selected urban construction projects in Tabriz, Iran. The use of questionnaires in this research was limited to engineering personnel in project management system to identify the influencing factors within the project and the sustainable outcomes regarding the project. The overall number of potential participants in this study could be about 80-120 engineers and technicians. In order to calculate the size of sample for the questionnaire in this survey, a table designed for determination of small sample size introduced by Krejcie and Morgan (1970) was employed. The validity of sample size was found to be 66 to 92 sets of questionnaire. In order to reduce the possibility of any kind of missing questionnaire during distribution or collection, 100 questionnaires were handed out. The questionnaires were returned from 75 project staff who fully contributed to the selected construction project implementation. The Statistical Product and Service Solutions (SPSS) is a suitable tool and was used in this research to obtain precise numeric results mainly from the results of questionnaire survey. The descriptive, correlation, and inferential statistics were included in the final process of data analysis.

3. Findings and Discussions

In this study, descriptive statistics were used in order to analyze the demographic data in selected construction projects. The purpose of the analysis in this section was to identify the key technical characteristics of the projects and the project staff. For the construction project characteristics, the research investigated into location, project duration, project size, estimated effect size, key activities, and key outputs of the selected projects. The demographic data of the projects are demonstrated in Table 1.

Table 1. The urban construction projects' information.

	Project 1	Project 2	Project 3	Project 4
Project location	Urban Setting	Urban Setting	Suburban setting	Urban Setting
Project duration	3 years	2 years	2 years	2 years
Key project activities according to budget allocation	Excavation and sub-base (23.7%)	Planning (14.6%)	Project staff capacity development (13.6%)	Planning and Staff recruitment (34.9%)
	Construction (16.2%)	Excavation and Construction	Project Construction	Construction (20.1%)

		(14.2%)	(13.2%)	
	Finishing (15.9%)	Finishing (13.5%)	Finishing (12.6%)	Finishing (16.9%)
Key outputs	Improved access of citizens to final services	Increased utilization of transportation facilities	Increased utilization of public open spaces	Improved access to Quality urban spaces
	Improved knowledge and awareness to urban services	Behavioral changes among citizens	Behavioral changes towards walking	Behavioral changes towards social interaction
	Strengthened Urban management			

From the collected data, it was clear that project staff training and capacity development were the key activities in most of the studied construction projects. Meeting with project managers was found as a primary method in project communication. The common key outputs of the projects were to increase access to technical services and to education.

4. The urban construction project structure

To clearly understand the management of the undertaken construction projects, the research examined the project structures through the survey questionnaire from the project respondents. Four common types of management structures included within the questionnaire were functional, matrix and designed structures. Characteristics of each structure elaborately was described in the survey questionnaire according to the PMBOK® Guide (PMBOK, 2013). Descriptive statistics were employed to generate the results from the questionnaire. It was found that 61.3% of the respondents reported a functional structure in the selected projects while the matrix and the designed structure ranked the second and third with the percentage of 22.7% and 13.3% respectively.

It was led to believe that the functional structure employed in the urban construction projects was established using the traditional structure deployed by contractor. The specific units or departments within the organizations of client were assigned to undertake and control the projects. The projects were under supervision of Tabriz Municipality who acted as the supervisor or project managers. According to Meredith and Mantel (2012), advantages of the functional project structure include better flexibility of project workforce and the potential for workforce rotations between different projects, opportunity for sharing knowledge and experience among project staff, continuous and easier flows of project resources and an opportunity of professional development for organizational staff.

5. Project management training

To understand the association between the project management team knowledge, sustainable outcome knowledge, and project management training among

urban construction project members, an examination was further undertaken by using correlation analysis. The results of the association between the factors mentioned are demonstrated in Table 2. According to Jackson (2009), when in such a survey, the values of correlation coefficient (r) are achieved to be between +/- 0.00 to 0.29, +/- 0.3 to 0.69 and +/-0.7 to 1.00, they are indicative of no relationship to a weak relationship, a moderate level of relationship and strong relationship respectively. In this study, it was found out that provision of PM training to the urban construction project members led to positive relationships at a moderate level to consecutive training, knowledge gained in PM and contribution of PM knowledge to sustainable outcome knowledge within the surveyed projects (correlation coefficient values of 0.323, 0.365 and 0.307 respectively). Moreover, gaining PM knowledge in this survey, led to a significantly higher level of positive relationship (r =0.757) to the contribution of PM knowledge to desired sustainable outcome knowledge. It could be concluded that the higher knowledge gained in PM, the higher contribution of PM knowledge to sustainable outcome knowledge built up in the urban construction projects.

Table 2. Association between PM training, PM consecutive training, PM knowledge and sustainable outcome knowledge.

		Provision of PM training to project team	Consecutive PM training	Knowledge gained in PM	Contribution of PM knowledge to sustainable outcome knowledge
Provision of PM training to project team	Correlation Coefficient	1.000	.323**	.365**	.307**
	Sig. (2-tailed)	.	.005	.001	.007
	N	75	75	75	75
Consecutive PM training	Correlation Coefficient	.323**	1.000	.180	.087
	Sig. (2-tailed)	.005	.	.122	.458
	N	75	75	75	75
Knowledge gained in PM	Correlation Coefficient	.365**	.180	1.000	.757**
	Sig. (2-tailed)	.001	.122	.	.000
	N	75	75	75	75
Contribution of PM knowledge to sustainable outcome knowledge	Correlation Coefficient	.307**	.087	.757**	1.000
	Sig. (2-tailed)	.007	.458	0.00	.
	N	75	75	75	75

**The obtained correlation is significant at the 0.01 level (2-tailed); *The correlation is found out to be significant at the 0.05 level (2-tailed).

6. Evaluation of Sustainable Outcomes in Urban Construction Projects

It is important for the research to identify sustainable outcomes aimed to achieve by the target urban construction projects. Ten concepts obtained from the review of existing literature were included in the survey questionnaire with an extra opportunity provided for the respondents to address other intended definitions besides those that were given. To demonstrate the responses on sustainable outcomes of the target projects, a descriptive statistical analysis was conducted.

Sustainable outcomes reported from the selected urban construction projects are as illustrated in Table 3. It was discovered that 70.7% of 75 respondents selected continuation of project benefits after the funding termination as a meaning to explain sustainable outcomes of the urban construction projects, whereas subjects covering the integration of construction activities into organizational routine activities and the increase in knowledge and technical competencies of staff were ranked as subsequent influential meanings (agreed by 56.0% of 75 respondents for both definitions). In contrast, improved outcomes produced after project termination received the least support from respondents (13.3%). Understanding types of sustainable outcomes could help future urban construction projects in planning long-term implementations to achieve the outcomes the projects as well as the sustainable urban development.

Table 3. Expected Sustainable outcomes in the urban construction projects.

Rank	Sustainable Outcomes	Percentage
1	Continuation of construction activities	70.7
2	Integration of construction activities into organizational structure	56.0
2	Increase in individual knowledge and technical competencies	56.0
3	Increase in overall organizational competencies	48.0
4	Continuous improvement in quality of life	46.0
5	Integration of construction culture to organizational culture	30.0
6	Increase in chances for provision of future resources	28.0
7	Integration of construction framework into organizational framework	24.0
8	Same outcomes produced after project termination	20.0
9	Increase in organizational reputation for client	18.7
10	Improved outcomes produced after project termination	13.3

7. Contribution to Achievement of sustainable outcome

It was evident in the previous section that PM knowledge could contribute to better sustainable outcome knowledge among staff. This section revealed association between sustainable outcomes targeted by the urban construction projects and project management staff knowledge. Statistical method of chi-square ($\chi2$) was employed to produce the results of association. Chi-square is the method for comparing between two or more categorical variables obtained from a questionnaire survey. The results of $\chi2$ indicate statistical significance of association when p-value is less than 0.05 (at 95% confidence intervals). The findings of this research included the measures of Cramer's V

association to find out the strength of the association between the tested variables. According to Parker and Rea (2005), the measurement achieved from Cramer's V association can be applied from 0.00 to 1.00. The closer the value to 1.00, the stronger the relationship is. The relationship is considered weak, moderate and strong when the values are 0.00 to 0.20, greater than 0.20 to 0.40 and greater than 0.40 to 1.00 respectively. It was found in this study that nine project knowledge areas contributed to at least one sustainable outcome targeted by the urban construction projects with moderate to high association. The results in Table 4 indicate that the integration of construction activities into organizational routines is able to form strong association with quality, human resource management, communications techniques and risk evaluation and management. Moderate association between various types of desirable sustainable outcomes can be vigorously achieved. The only item that did not contain an individual association with any particular types of sustainable outcomes was procurement management as the statistical significance indicated the p-value greater than 0.05, and therefore, the title of procurement management was excluded from the data in Table 4.

Table 4. Association between PMKAs and sustainable outcomes.

Knowledge areas	Types of sustainable outcome	χ2 (p < 0.05)	Cramer's V (p < 0.05)
	Improvement in individual knowledge and technical competency	7.587	0.318
Integration Management	Integration of construction culture to organizational culture	9.899	0.363
	Improvement in organizational reputation for contractor	11.418	0.390
Scope Management	Integration of construction activities into organization routines	8.872	0.344
	Improvement in individual knowledge and technical competency	10.017*	0.365*
Time management	Integration of construction activities into organization routines	10.776*	0.379*
	Integration of construction activities into organization routines	11.281*	0.388
Cost management	Improvement in individual knowledge and technical competency	6.208	0.288
	Integration of construction culture into organizational culture	8.077*	0.328*
Quality management	Integration of construction activities into organization routines	15.165*	0.453*
	Same outcomes produced after project termination	11.600*	0.396*
	Improvement in overall organizational competency	10.623*	0.379*
	Integration of construction culture into organizational culture	6.592	0.293
Human resource	Integration of construction activities into	18.662*	0.499*

management	organization routines		
	Same outcomes produced after project termination	6.431	0.293
	Improvement in overall organizational competency	9.234*	0.351*
	Integration of construction culture into organizational culture	9.191*	0.350*
Communications management	Integration of construction activities into organization routines	14.888*	0.446*
	Improvement in individual knowledge and technical competency	7.477*	0.316*
	Same outcomes produced after project termination	10.382*	0.372*
	Improvement in overall organizational competency	8.033*	0.327*
	Integration of construction culture into organizational culture	11.333*	0.389*
Risk management	Integration of construction activities into organization routines	15.868*	0.460*
	Improvement in individual knowledge and technical competency	6.990	0.305
	Same outcomes produced after project termination	11.509*	0.392*
	Improvement in overall organizational competency	6.861*	0.302*
	Integration of construction culture into organizational culture	10.495*	0.374*
Stakeholder management	Integration of construction activities to organization routines	10.724	0.378
	Continuous improvement in quality of life for citizens	7.691	0.320
	Same outcomes produced after project termination	8.882	0.344
	Improved outcomes produced after project termination	14.427	0.439
	Improvement in overall organizational competency	12.862	0.414
	Integration of construction culture to organizational culture	10.218	0.369

Conclusion

Urban construction project is a key component in sustainable urban development. It focuses on the development of urban infrastructure, public open spaces, and other urban functions and systems to provide for a state of physical, mental and social well-being of citizens. In many developing countries such as Iran, urban development projects are implemented in collaboration between the government and private sector including consulting engineers and contractors. Such projects operate

within fixed term duration of implementation but always with delay. As a result, the project funding is likely to be terminated before the expected outcomes of real urban development are achieved. In this case, sustainable outcome concepts play a crucial role. In order to attain sustainable outcomes in the urban construction projects, effective project management is required. The aim of this study was to investigate project management practice and a linkage between project management knowledge and sustainable outcomes in the four large scale urban construction projects undertaken in Tabriz, Iran. The findings revealed that provision of project management training to the urban construction project teams contributed to consecutive project management training and increase of knowledge in project management. The results of correlation test confirmed a high level of association between the level of PM knowledge gained to the contribution of PM knowledge to sustainable outcomes. Continuation of project benefits was also found to be the most desirable outcome of the urban construction projects. The investigation on the association between project management and sustainable outcomes targeted in the projects found eight knowledge areas in project management that could contribute to at least one sustainable outcome listed.

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