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Reliability and Validity of Project Success Achieved Instrument (PSAI): A Perspective from Small Public Construction Projects (SPCPs)

[1]Syaharudin Shah Mohd Noor, [1]Muneera Esa, [1]Ernawati Mustafa Kamal, [2]Aida Azlina Mansor
[1]School of Housing, Building and Planning, Universiti Sains Malaysia, [2]Faculty of Business and Management, Universiti Teknologi MARA, Malaysia
Email: syaharudin_shah@yahoo.com

Abstract
In the context of the construction management industry and particularly with the current expectations of various stakeholders, the dimensions of project success in the public sector are increasingly prevalent. In a more in-depth review, this study examines the reliability and validity of a new measure of project success based on the Malaysian Small Public Construction Projects (SPCPs) context. This study uses a measuring tool called Project Success Achieved Instrument (PSAI) that consists of five dimensions with factor loadings ranging from 0.555 to 0.830. Although several researchers have recognized the PSAI as adequate to explain the project success framework, it has not been studied in developing countries with different perspectives such as Malaysia. The questionnaire was distributed to two major federal organizations, Implementation Coordination Unit, Prime Minister Department (ICU JPM), and Ministry of Rural Development (KPLB), which involved 137 active project managers. The reliability and validity of the instrument appear to be very promising and implications of the results for further research shall be discussed.
Keywords: Project Management, Project Success, Project Success Instrument, Small Public Construction Projects, Smart PLS

Introduction

Project management is a worldwide well-established business field and has been used for thousands of years, particularly in the glorious Egyptian era (Seymour & Hussein, 2014). Today, project management is much more complicated than ever because of massive investment in infrastructure, including many disciplines, wide-ranging project participants, tighter schedules, rigid quality requirements, increased spending, environmental shocks, and increased knowledge power among the stakeholders (Daniel, 2019). As such, project management tends to play a dynamic key role in balancing factors that are evolving to ensure the success of the organization, particularly in coordinating people's projects. This is supported by Machado and Martens (2015) who perceive project management as the primary method for an organization to establish its mission of achieving its goal effectively. Thus, the management of Small Public Construction Projects (SPCPs) is no exception in contributing to

the effective delivery of services, where the project success is an important factor in assessing the performance of the business (Cheong & Mustaffa, 2017). However, past research on construction management has paid little attention to the project's success factors (Hassan, Bashir, & Abbas, 2017). This includes measuring methods of project success criteria that are compatible with existing demands, which obviously need to be adjusted due to the cultural and global perspective especially for the developing countries (Khalid Ahmad Khan, Turner, & Maqsood, 2013). Therefore, the study aims to fill the gaps by examining the reliability as well as the validity of selected project success instrument in order to further enhance understanding of the current local construction management industry scenario in the Malaysian context.

Research Background

This study briefly touches on the project success dimensions, a background of Small Public Construction Projects (SPCPs) and Project Success Achieved Instrument (PSAI) that is closely linked to the overall context of the subject.

Project Success Dimensions

Project success emerged during the late 1980s comprising two components: the success of the project itself as indicated by time, cost, performance subcomponents, and client success, and as reflected by use, satisfaction, and effectiveness of the project is benefiting intended users (Pinto & Slevin, 1987). Similarly, Kerzner (2003) defined project success as completion within time, cost, and specifications (the traditional triple constraints) as well as with minimum or mutually agreed on scope changes and acceptance by the client/user. The success of a project also can be determined from the perspective of the means (itself) or the end (expected to accomplish) depending on the interests of the stakeholder or the people on the ground (Bannerman, 2008). Furthermore, regardless of means or ends, expectations of what the project is to achieve and perceptions of whether it achieved them often vary among stakeholders. This makes the success of the project highly dependent on the expectations, perceptions, and assessments of different stakeholders (Wit, 1988). Project success also has long been considered the ability to fall within time, cost, and quality constraints. The “time/cost/quality triangle” or “iron triangle,” or the “golden triangle,” that some professionals call the “Holy Trinity” or the “Triangle of Virtue” sufficed as a definition of project success (Atkinson, 1999). This is contrary to the view of Jugdev and Müller (2005) who examined the literature of many years of project success and found that the "iron triangle" could no longer be used within its restricted limits (scope, time, and cost). Project success is also known as achieving goals and objectives that have been well defined before but measured when the project is closed (Müller & Jugdev, 2012). On the other hand, project success based on Khalid Ahmad Khan et al. (2013) depends on scope, sectors, industries, activities, geography, and time. Table 1 illustrates the dimensions of project success in the depth parameters that the researchers investigated according to the applicable criteria.

Table 1: Project Success Dimensions

Researcher	Criteria						
	Project Efficiency	Impact on the project team	Impact on Customer	Business Success	Preparing for the future	Project Profile	Stakeholders Satisfaction
Atkinson (1999)	/		/	/			
Andersen, Dyrhaug, & Jessen (2002)	/		/		/		
Rad (2003)	/		/			/	
Diallo & Thuillier (2004)	/		/				
Bryde & Robinson (2005)	/						/
Yu, Flett & Bowers (2005)	/		/	/			
Müller & Turner (2007a)	/	/	/	/			/
Shenhar & Dvir (2007)	/	/	/	/	/		
Thomas & Fernández (2008)	/			/			/
Al-Tmeemy et al (2011)	/		/	/			
Turner & Zolin (2012)							/

Source:Adopted from Khalid Ahmad Khan et al., (2013)

Today, the public sector concentrates more on reducing costs and pleasing stakeholders while the private sector focuses on rising efficiency (Toor & Ogunlana, 2010). This is supported by Ozguler (2016) that the government's public sector project success is a major concern as a substantial number of stakeholders are impacted if the growth goal is not achieved. Meanwhile, Maimun (2010) has studied the critical factors of project success for the public

sector and discovered four key steps that need to be taken: time, cost, quality, and stakeholders. Therefore, several attempts have been made from various perspectives to identify appropriate success measures that could be used to improve the performance of public projects. This includes what Takim and Adnan (2008) pointed out, which is efficiency assessments are linked to project outcomes during construction and consider many variables, including customer fulfilment, stakeholder goals, learning and leveraging, and organizational guarantee and user satisfaction.

Project Success Achieved Instrument (PSAI)

In accordance with the above, a range of models was designed to measure the success of a project in public sector organizations specifically for developing countries, including an instrument created by Khalid Ahmad Khan et al. (2013) called the Project Success Achieved Instrument (PSAI). The PSAI is also considered to be very useful for research in developing countries, especially Malaysia, as its aspect has taken a strong stance to holistically evaluate the success of the project. This is also supported by the latest findings by Irfan and Mazlan Hassan (2017) on the success of the project from the public sector perspective in developing countries and found that the project dimension requires integrity, sincerity, stakeholder interest, and more accountability with project information being implemented. Therefore, in this paper, PSAI is chosen due to the factors described in developing a new model that consisted of five distinct dimensions as shown in Table 2 below:

Table 2: Five Dimensions of Project Success

No.	Variable	Description
1.	Project Efficiency (PE)	"Project effectiveness" measures how time and resources are used efficiently to generate outputs with the required quality in the public sector.
2.	Organizational Benefits (OB)	This dimension has five elements related to macro success-long-term success, business success, learning, and motivation. These classifications are connected with advantages derived from the completion of a project by an organization.
3.	Project Impact (PI)	This factor comprises four items that relate to project outcomes or efficiency. The reputation of the project is established by the benefit of the project. The literature classifications of factors included impact, project purpose achieved, overall project success, and goals. The long-term outcomes of a project's successful completion are described as an effect on the growth of the public sector.
4.	Stakeholder Satisfaction (SS)	This factor has four items covering the goals of a sponsor, steering group, client, and organization. Customer satisfaction, product success, and project management success are included in the literature categories for factors in this factor. Stakeholder satisfaction was chosen to cover distinct groups as the label for this factor.
5.	Future Potential (FP)	This factor has four items that relate to the ability of an organization to undertake project work in the future to enable, motivate and improve it. In this factor, the literature categories for factors include learning, motivation, planning, and implementation.

Hence, this model is sensitive to public sector projects and provides a comprehensive view of the success criteria that comprise PSAI, which is proposed to measure the project success construct. To the best of our knowledge, there is no prior research that specifically examined this model from the view of the Malaysian construction industry, particularly on SPCPs.

Small Public Construction Projects (SPCPs)

The construction industry is vital to any nation's progress, and the physical development of construction projects such as structures, roads, and bridges is a measure of their economic growth (Alzahrani & Emsley, 2013). According to Project Management Institute (2013), construction projects have defined objectives, while the scope is slowly built over the entire project life cycle and project managers manage the project team to achieve their project goals. In other words, it is important to consider the similarities and differences between these disciplines to understand the project. According to Rowe (2007) most organizations rely on a variety of project types, which are small, medium, and large, and regardless of the project size, the project manager is responsible for project success. In Malaysia, public projects are a basic need, which is oriented by aspirations and holistically benefit the public. In this regard, public projects in Malaysia are divided into three categories which is large, medium and small project categories carried out according to the benchmark under the Five Years Development Plan (FYDP) (Unit Penyelarasan Pelaksanaan, 2015).

For the purpose of this paper, SPCPs are those with a value of less than RM500,000.00, considered by small teams, and require the balance of project managers to make efficient decisions (Kementerian Kewangan Malaysia, 2011, 2014; Unit Penyelarasan Pelaksanaan, 2015). SPCPs are normally delivered between 1 to 6 months, depending on the project type and complexity (Kementerian Kewangan Malaysia, 2011). In another perspective of SPCPs, it is a supplement and complement to major construction projects under FYDP. Examples of SPCPs include maintenance projects, hall construction, drainage systems, renovations/construction of roads (rural), streetlights, suspension bridges, and public basic infrastructure upgrades

Research Method

When carrying out this study, quantitative methods were used based on the above description. A total of 137 project managers from Implementation Coordination Unit, Prime Minister Department (ICU JPM), and Ministry of Rural Development (KPLB) were chosen as respondents for this study in 14 states in Malaysia. This sample size is sensitive as a sample size of 30 is considered satisfactory by Roscoe (1975) and supported by Hogg and Tanis (2005) that indicated the sample size must be greater than 25 or 30. In the analysis and interpretation of results, the response rate of 97 per cent (133) (see Table 3) and the judgmental sampling technique was used. In this type of sampling, subjects with the specific aim of being directly involved as active project managers of the SPCPs were selected as samples. They were required to complete the survey, which is linked to the success of the SPCPs by the five-point Likert scale (1 = not successful to 5 = very high successful). Smart PLS version 3.2.8 was used for data analysis to explore the reliability and validity of PSAI from the project manager's self-assessment perspective.

Table 3: Respondent Profile

Subject		Frequency	Percentage (%)
Gender	Male	79	59.4
	Female	54	40.6
Age	18 - 24	0	0
	25 - 34	30	22.6
	35 - 44	87	65.4
	45 - 54	15	11.3
	55 and above	1	0.7
Ministry	Implementation Coordination Unit (ICU JPM)	106	79.7
	Ministry of Rural Development (KPLB)	27	20.3
State (Zone)	Northern (Perlis, Kedah, Penang)	26	19.6
	Centre (Perak, Selangor, Wilayah Persekutuan)	33	24.8
	Southern (Melaka, N.Sembilan, Johor)	20	15.0
	East (Kelantan, Terengganu, Pahang)	28	21.0
	Borneo (Sabah, Sarawak)	26	19.6
Project Management Field	Yes	57	42.9
	No	76	57.1

Table 4: PSAI Measurement Model Assessment

Constructs	Items	Indicator Reliability	Internal Consistency			Convergence Validity
		Factor Loadings	CR	Cronbach's Alpha (CA)	rho_A	AVE
PSAI Small Public Construction Projects (SPCPs)	FP1	0.712	**0.962**	**0.959**	**0.964**	**0.508**
	FP2	0.642				
	FP3	0.766				
	FP4	0.789				
	OB1	0.659				
	OB2	0.735				
	OB3	0.618				
	OB4	0.777				
	OB5	0.719				
	PE1	0.572				
	PE2	0.611				
	PE3	0.555				
	PE4	0.590				

PE5	0.580
PE6	0.757
PE7	0.716
PE8	0.655
PI1	0.752
PI2	0.826
PI3	0.805
PI4	0.719
SS1	0.743
SS2	0.820
SS3	0.745
SS4	0.830

In Smart PLS, the construct measurement model assessment as shown in Table 4 includes three key criteria, namely Indicator Reliability (IR), Internal Consistency (IC), and Convergence Validity (CV) (J. F. Hair, Hult, Ringe, & Sarstedt, 2014). The purpose of assessing IR is to evaluate the extent to which an indicator is consistent with what it intends to measure and factor loading values equal to or greater than 0.5 are acceptable (Bryne, 2016; Urbach & Ahlemann, 2010). In the meantime, based on Gefen, Straub, and Boudreau (2000) IC consists of Composite Reliability (CR), Cronbach's Alpha (CA), and rho A. However, CR is more appropriately applied with a different measure of IC and the acceptable value for CR is ≥0.60, which can be regarded as satisfactory (Gefen et al., 2000). Meanwhile, the next step is to ensure the CV of the construct in the analysis with an Average Variance Extracted (AVE) value ≥0.5 is acceptable (Bryne, 2016; Hulland, 1999).

Thus, based on the above findings, it has been demonstrated that IR (factor loadings) values are ≥0.5, hence all the 25 loadings that exceed the recommended values are retained. Moreover, all the five constructs (FP, OB, PE, PI, and SS) met the threshold values / minimum cut off values for CR (0.962), Alpha (0.959), and Rho A (0.964) where all the CRs are greater than 0.7 (J. Hair, Hult, Ringle, & Sarstedt, 2017). In addition, CV indicates that AVE (0.508) greater than 0.5 is more than the value suggested by (Bryne, 2016; Hulland, 1999). It can be concluded that the PSAI constructs meet the reliability and convergent validity requirements at this stage. Overall, the PSAI measurement model reliability and validity evaluation are therefore satisfactory and validated in the Malaysian context.

Discussion, Implications and Limitations

This study explicitly reflected the academic/practical results of the project success instrument in the construction management industry, particularly in the context of public service in Malaysia and developing countries. Based on the findings by Khalid Ahmad Khan et al. (2013), in developing countries such as Pakistan, the reliability and validity indicate that CV value of 0.893, as well as the IR range, are between 0.484 and 0.749. This is also supported by Irfan & Mazlan Hassan (2017) using the same instrument, they stated that the CR (0.900), CA (0.873) and IR range is between 0.634 to 0.874. In the attempt to test the PSAI reliability and validity in the sense of the SPCPs, the results of this analysis (as shown in Table 4) indicate that the findings in the Malaysian context for this instrument are slightly higher than Pakistan. As such, the reliability and validity test for PSAI measurements is verified by both countries, in

particular by project managers involved in providing a self-assessment scale to determine the success of the project in the field.

Meanwhile, in terms of theoretical implications, PSAI findings have added effective methods of evaluating project success to the literature in the global construction industry. There have been limited studies of project success focusing on reliable instruments in the past, mainly in developing countries and particularly in the public sector. Not only that, the present study provides a basis for researchers interested in this area to further examine the use of PSAI as resources in other industries (not limited to construction). Besides, the study provides useful guidance for researchers to concentrate on the success of small projects that are often not taken seriously by the concerned parties when compared with large-scale projects. Meanwhile, at the managerial level, this study also enhances management understanding of the diverse project success dimension and provides an appropriate instrument to ensure that they always meet the needs of internal/external stakeholders holistically. The findings of this analysis should consider several limitations. First, the sample size is limited to 137 project managers. Next, this analysis was cross-sectional in which data were collected within a short time frame and delivered only to public sector project managers in selected agencies. Lastly, since this study is confined to the PSAI and SPCPs, it would be interesting to explore other instruments with different variables to further enhance insights into different aspects.

Conclusion and Future Research

In conclusion, these findings indicate that the reliability and validity of PSAI towards the SPCPs in Malaysia are reliable and verified. It is also compelling, in addition to supporting previous research, that PSAI had a positive effect on the SPCPs success nationally. Consequently, the findings of this study on the reliability and validity of the PSAI in Malaysia offer a fresh impetus as well as enhancing knowledge of public construction management.

This study contributes to the theoretical and contextual aspects to supporting previous studies as well as provides a basis for understanding that the instrument of project success can be more effectively explored for use in various countries. Moreover, by disclosing the development of project success, particularly in the context of SPCPs, it also contributes to the growth of knowledge in project management literature and practices. Besides that, the study encourages future research to pursue several other directions in order to address these limitations that include: i) increasing the sample size; ii) unexplored ministries/agencies as well as private sector involvement, and iii) researching different project success instruments in order to enrich the body of knowledge. Finally, this result indicates that the PSAI tool plays a significant role in ensuring the achievement of the expected (success) growth agenda and leads to a certain degree of empirical understanding.

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