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A Study on Relationship between Project Management Function, Technology Utilization and Project Performance

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ABSTRACT

This study investigates the relationship of three main variables: project management function, technology utilization, and project performance. Project management function element is made operational by the nine constructs; and the technology utilization element examined in this study focuses on three factors. Data were collected by using questionnaire survey approach. This study employed stratified random sampling procedure in selecting the construction organizations to be included in the sample. Four hundred and forty eight Aceh construction organizations participated in this study. A bivariate pearson product-moment correlation analysis was utilized for hypotheses testing. In general, all dimensions of related project management positively function with the dimensions of project performance with the value of the correlation ranged between r=0.165and r = 0.482, and a one-tailed test of statisticalsignificanceat significance level p <0.01. Correlation analysis resultsalso show that all the variables of technology utilization and project performance are significantly and positively correlated with the correlation between r = 0.245and r = 0.550, and a one-tailed test of statistical significance at significance level p <0.01. The outcome of this study provides vital information on the relationship between project management function, technology utilization and project performance in Aceh construction organizations. This study also provides an insight into further understanding on the issue of interface between project management function, technology utilization and project performance.

Keywords: project management, project management function, technology utilization, project performance, *bivariate pearson product moment.*

1. INTRODUCTION

Historically, project management was a responded to the need ofcreating civil and construction works of some complexities. In the 1950s project management achieved greater prominence when the planning and control concepts were

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applied to much more complex projects such as those of the US navy and, subsequently, NASA space projects. In the last couple of decades, project management has emerged as a business process tool with boarder application in the corporate world (Shenhar & Renier, 1996).

In the upcoming era of globalization, the challenge in construction industry is getting very strict and complex. Project management role becomes very important in supporting construction industry. At this time, the development in specific field of construction project management especially in Indonesia has not shown progress in the sight of the emerging challenges. However, many contractors still assume that project management as is a new tool because many project managers in Indonesia have less knowledge and technology. Only a small number of contractorshave been exposed to project management (Henry, 2008).

Recently, the project management has been key activity in most modern organizations in Indonesia; however, only big project simplement the project management (Pujoartanto, Soemardi, Wirahadikusumah & Abduh, 2003).

Since the late 1960s (at least) project management researchers have been trying to discover (which) what factors led to project performance (e.g. Pinto & Slevin, 1988b) and have reached conclusions that have been widely reflected in literature written for project management practitioners (Cooke & Davies, 2001).

Most of the early studies in the area focused on the causes of project failure rather than project success (Balachandra & Raelin, 1984). In those studies it was assumed that if a project completion time exceeded its due date, or expenses overran the budget, or outcomes did not satisfy a company's pre-determined performance criteria, the project was assumed to be a failure. Today we know that determining whether a project is a success or a failure is far more complex (Belassi & Tukel, 1996).

In recent decades, there has been a remarkable growth in the number, size, and complexity in large infrastructure projects in many developing countries. Management of projects deals with the will of uncertainty that may arise from the project. Uncertainty is the root cause of project delays and a decrease in organizational performance (Ofori, 1991; Ogunlana, Promkuntong & Jearkjirm, 1996).

In Indonesia, the government judged the reputation of contractors on the basis of their experience and performance in meeting the projects due rather than their performance in the field of project management. Conversely, the failure of the project in Indonesia is caused by several factors including the lack of monitoring and coordination. Thus, the effectiveness of project management in Indonesia is still low (Bay, Skitmore & Susilawati, 2005).

Aceh is one of 32 provinces in Indonesia. Banda Aceh is the capital of Aceh province, the most severely affected by the tsunami six years ago (December 26, 2004). To avoid failure of the projects in the Province of Aceh, the Rehabilitation and Reconstruction Agency (BRR) played a role in the planning, construction designing and supervision the projects conducted by the contractors. Given the large number of infrastructure development that must be were rebuilt, the new buildings were expected to be better than before (Reza, 2006).

The reconstruction and recovery program executed in Aceh after the tsunami of December 26 2004 has resulted in slumps (that has been since December 26 2004). This was due to that the against individuals and communities in Aceh is a resources and finance is available in Aceh isvery limited.The project implementers should be improve theefficiency and effectiveness of their project management (Wood, 2008).

The scope of this study is limited to Aceh Province. The number of construction agencies/organizations in the Province of Aceh was 2,334. They worked on that manages the construction projects is a ranging from grade 2 to grade 7 (Lembaga Pengusaha Jasa Konstruksi Indonesia, 2009).

2. LITERATURE REVIEW

2.1 Project Management

Project management can be used as a tool to maximize the performance of a project. Empirically, there is strong evidence that the practice of project management knowledge can affect the project performance (Jaselskis & Ashley, 1991).

The search for factors that lead to better project performance and success spans many years of research. The project management literature has dealt extensively with factors affecting projects' performance (Slevin & Pinto, 1987; Pinto & Slevin, 1988b).

According to the PMI's *A Guide to the Project Management Body of Knowledge*, or the PMBOK Guide, project management is the application of knowledge, skill, tools, and techniques to a broad range of activities in order to meet the requirements of a particular project (*Project Management Institute*, 2000).

Project management is one of the fastest growing disciplines in organizations today (Shenhar & Dvir, 2007), and it is one of the crucial aspects of the entire construction process (Levy, 2000). Project management, as a profession and area of research, continues to grow and develop. In order that project management can being applied in new industries, countries and application areas, the demands for project management continue to change (Crawford, Pollack & England, 2005).

For almost 30 years, project management was viewed as a process that might be nice to have, but not one that was necessary for the survival of a firm. Companies reluctantly invested in some training courses simply to provide their personnel with basic knowledge on planning and scheduling. Project management was viewed as a threat to established lines of authority and, in most cases, only partial project management was used. This half-hearted implementation occurred simply to placate lower and middle-level personnel (Kerzner, 2000).

Kloppenborg & Opfer (2002) provided a detailed review of project management research, covering more than 40 years of publications. According to their observations, project management research was focused on planning and scheduling during most of the 1960s. In the 1970s, automated software of project management has created an increased interest in cost and schedule control. This trend continued into the 1980s, with new studies on life-cycle costing and risk management planning. Yet, that time also marked the appearance of studies on team building and leadership, leading to the 1990s, with even more focus on human resources, teams, and leadership.

However, project management is difficult to establish conclusive distribution of project size or practice over industry sectors, as responses to surveys are subject to sample bias. The influence of industry bias was identified by Evaristo & van Fenema (1999), who stated that “the current knowledge based on the management of projects emanates from large capital construction projects responsible for only 10% of the projects”. Betts & Lansley (1995) found in project management that “by far the most frequently addressed industry was construction”.

Today, business has changed for the better. Trust between the customers and contractorsis on all-time demand. All of these factors have allowed a multitude of companies to achieve some degree of excellence in project management (Kerzner, 2000).

In the next century there will emerge a new group of project management professionals whose expertise will be centered in the implementation of project management rather than in general knowledge on the principles of project management (Kerzner, 2000).

2.2 The Project Management Knowledge Areas

New topics that are promising to researchers(Morris & Hough, 1986) who focus on project management is the application of *Project Management Body of*

Knowledge (PMBOK) as one way to improve the project performance used as a lens for project management research (*Project Management Institute*, 2000). Morris & Hough (1986) used project function, project management and the contractor's business performance to measure project performance.

The Project Management Body of Knowledge areas describe project management knowledge and practice in terms of their component processes. These processes have been organized into nine knowledge areas: project integration management, project scope management, project time management, project cost management, project quality management, project human resource management, project communications management, project risk management, and project procurement management(*Project Management Institute*, 2000).

2.3 Project Performance

Performance is a matter that is not tangible, especially in the case of management performance, so choosing a tool to evaluate the performance is also a hard work. So, the assessment tool to improve project performance is required to create a best of the best organizations (Qureshi, Warraich & Hijazi, 2009).

The definition of project performance is vague and there is no universal acceptance criteria used for its measurement (Jha & Iyer, 2007). Lim & Mohamed (1999) defined criteria as the set of principles or standards by which judgment is made and are considered to be the rules of the game.

According to Khang & Moe (2008), project performance is measured against the achievement of the project owner's strategic organizational objectives and goals as well as the satisfaction of the users' and key stakeholders' needs where they are related to the project's final product.

Traditionally, project performance is evaluated in light of schedule, cost, and quality performances, which arealso known as the "iron triangle" (Atkinson, 1999). Subsequently a number of researches have proposed different sets of performance evaluation criteria in addition to the iron triangle.

One of the functions of construction project management is to ensure the performance of a construction project. However, achieving success in a construction project is not a small task. Moreover, measurement of performance of a construction project itself is considered to be a debatable issue as there are no universally accepted criteria for it (Jha & Iyer, 2007).

Since the late 1950s most of the work in project management has focused on project scheduling problem, assuming that the development of better scheduling techniques will produce better management and project completion performance (Belassi & Tukel, 1996).

At the end of 1993, a group of 15 large private sector companies to form established Europe's first project management knowledge network of human systems to identify best practices in project management, and to learn together how to improve the performance of project (Cooke-Davies, 2001).

2.4 Project Performance Factors

Performance is measured in subjective and objective ways and it means different things to different people (Freeman & Beale, 1992). During period 1 (1960s-1980s), simple metrics such as time, cost, and specifications were used to rate project performance because they were easy to use and within the realm of project organization.

Project performance factors are elements of project management that can influence and increase the chance of achieving a successful outcome. The reverse, pitfalls, are management mistakes which increase the chance of failure (Morris & Hough, 1987; Wateridge, 1998; Jugdev & Müller, 2005; Turner, 2009).

Without the willingness and dedication of the manager and the team members to perform, competencies are useless. Motivation factors recognized in the literature include clear understanding of a project goals, objectives and mission. This understanding should be supplemented by the commitments to the project performance by all the project team (Belassi & Tukel, 1996; Andersen & Jessen, 2000; White & Fortune, 2002).

Project Management Institute (1996) identifies nine knowledge functional areas: project integration management, project scope management, project time management, project cost management, project quality management, project human resource management, project communications management, project risk management, and project procurement management.

Young (2000) found six factors of performance project. The concept of the project comprises; project definition, project planning, launch and implementation of projects, closure of projects and project evaluation.

A good project governance concept is developed to evaluate the performance of the project, especially in strategic issues. Such evaluation is necessary to assess the project’s overall performance in addition to evaluating the project management process and product performance (Abednego & Ogunlana, 2006).

Reportedly, performance of projects differs by nationality. Both North America and Australia achieved higher level of stakeholder satisfaction rate than Europe did. Other parts of the world reported higher achievements of user requirements than Europe did (Müller & Turner, 2007).

Müller and Turner (2007) identified nine performance factors for projects. They are to meet the needs of users, the goals of the project, business survival, customers' satisfaction, end users' satisfaction with the team, stakeholders' satisfaction, providers' satisfaction, and other criteria.

With the many opportunities in China, foreign architectural, engineering and construction (AEC) firms are expected to enter construction industry as project performance is multi-faceted. The statistical analysis revealed that the projects managed by Singaporean firms in China had achieved success in budget and quality performance and owner and public satisfaction, but not in time management performance.

2.5 Project Performance Criteria

Project performance criteria are the measures by which we judge the successful outcome of a project (Morris & Hough, 1987; Wateridge, 1998; Jugdev & Müller, 2005; Turner, 2009).

Defining criteria to measure project performance has been recognized as a difficult and controversial task (Baccarini, 1999; Liu & Walker, 1998). Performance and failure attributes have varying impact on performance, which depends upon the performance criteria adopted by researchers. While some of the factors have been highlighted to be too important and critical in one literature, the same factors may not bear any recognition in the other (Thomas, *Tucker & Kelly*,1998; Sadeh, Dvir & Shenhar, 2000; Bower, Ashby, Gerald & Smyk, 2002; Lim & Ling, 2002; Dvir, Raz & Shenhar, 2003).

The literature to the mid-1980s listed performance factors using anecdotes and single case studies (Pinto & Prescott, 1988). Project performance contributed to excellence within in terms of time, cost, and quality management (levels) sepheres (Kerzner, 1989).

In the early 90s', project performance was inherently tied to performance measures, which in turn were tied to project objectives (cost, time and quality as the project performance criterion though there are many skeptics). Though, there are many scepticisms about viewing cost, time and quality as of project performance criteria (Deane & Clark, 1997; Shenhar, Levy & Dvir, 1997; Atkinson, 1999; Turner, 1999; Navarre & Schaan, 1990).

Performance is defined as one where the stakeholders are satisfied with the outcomes. These elements were noted by both Morris & Hough (1987) and by Turner (1999).

The inclusion of satisfaction as a performance measure can be found earlier in the work of Wueliner (1990). And, Munns (1995) investigated whether the cost, time, quality and customer satisfaction were the criteria for project performance.

Time, cost and quality are the basic criteria to project performance. Almost all related articles mention about these three aspects and point out the importance of them in a construction project and in the views of project participants such as found in Walker (1995;1996), Belassi & Tukel (1996), Hatush & Skitmore (1997), Pinto & Slevin (1988c), Archibald (1992), Baccarini (1999),Turner (1993), Westerveld (2002), and Belout & Gauvreau (2003).

Atkinson (1999) identified these three criteria as the ”Iron Triangle”. The three of them are the important parameter to the project managers who are usually associated to the project’s target. The measure of project performance is how far the triple constraints can be filled out (Soeharto, 1998).

The study conducted by the World Bank also found that between 1994 and 1999 the total private investment in Indonesia infrastructure was more than US$20 billion in which transport sector led in terms of the number of projects, which was with 20 infrastructure projects. The key participant in this case study was the government as the owner of the project, which in this case was represented by PT. Jasa Marga, and the private sector which was represented by the contractors and the end-users of the tollroad. The survey analyzed the perception of success for the tollroad project in terms of its serviceability, functionality and safety (Abednego & Ogunlana, 2006).

Traditionally, time, cost and quality are usually referred to as the "iron triangle".This has been accepted as the most widely used criteria for measuring performance (Wateridge, 1998; Jha &Iyer, 2007). Cost, time and quality, over the last 50 years have become inextricably linked with measuring the performance of project management. This is perhaps not surprising, since over the same period of time, those criteria are usually included in the description of project management. Time and cost are best guesses, typically calculated when less is known during the planning phases, and quality is an attitude that changes over the project life cycle. The iron triangle comprises three well recognized criteria (cost, time and quality) against which project performance is measured (Atkinson, 1999).

Project performance means different things to different people. Each industry, project team or individual has its own definition of performance. The measurement of project performance in construction industry has traditionally been grounded in the industry-accepted classic objective performance metrics: cost, schedule, quality, and safety (Albanese, 1994; Lim & Mohamed, 1999; Hughes, Tippett & Thomas, 2004).

Literature of project performance measure on project management includes several careful empirical studies. Most of the stakeholders make an approach towards project performance (Pinto & Slevin, 1988c; Shenhar, Tishler, Dvir, Lipovetsky & Lechler, 2002).

Project performance is highly dependent of the projects in charge of implementing the role and function in these projects (Wesli, 2007). In investigating performance criteria on projects, Wateridge (1995) discovered that a necessary condition for project performance was for the stakeholders to have a common understanding of the performance criteria before the project started.

However, the majority of research practitioners (Pinto & Slevin, 1988a; Freeman & Beale, 1992; Shenhar*et al*., 1997; Baccarini, 1999) considered project performance as an important project management issue (Crawford, 2000). For instance, the PMBOK guide published by the *Project Management Institute* (1996) suggests that project performance criteria should include the “iron triangle” and key project stakeholder satisfaction (Wang & Huang, 2006).

Project stakeholders are individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or project completion performance (*Project Management Institute*, 1996). The project management team must identify, the stakeholders, determine what their needs and expectations are, and then manage and influence those expectations to ensure a project performance. So stakeholders’ satisfaction is a crucial part of project performance.

2.6 Technology utilization

Technology is a critical component, enabled knowledge management, or information technology with a solid foundation for solutions that automate and focus on the development, application, dissemination and knowledge sharing. Management tool that enables technological knowledge is enhancing knowledge generation, codification and transfer. Knowledge of technology tools can be classified into four technology areas such as hardware, software and databases, collaboration tools and intelligent devices (Rasli, Madjid & Asmi, 2004).

Nine project management knowledge areas are identified based on literature review and a number of interviews with construction professionals for pilot study research. The identification of these factors are based on their potential to influence the performance of the project through the process of implementation (*Project Management Institute*, 2004).

Many studies have shown that the construction industry is reluctant to apply new technologies; rather, it employs lower level technology than that applied by other industries. A national-wide survey conducted by the *Civil Engineering Research Foundation* indicated that the design and construction industry spent only 0.5% of its total revenues on research and development (*Civil Engineering Research Foundation*, 1997).

Two hundred and nine completed projects from across the U.S. have each been assessed for the levels of technology employed on the work function of 68 different common projects. In addition, the projects have been assessed for the levels of overall project cost and schedule performance attained. Specially, project technology usage findings were presented and analyzed according to project size. Composite project performance (a combination of project cost and schedule performance) findings were also presented and their relationships with technology usage were discussed. The results indicated that the project performance–technology relationships for medium and small projects were stronger than those for large projects. For medium and small projects, levels of project technology usage were positively associated with projects' levels of composite performance (Yang, O'Connor & Wang, 2006).

Back and Bell (1994) attempted to identify the impacts of using electronic data interchange on bulk materials management. A process model was developed during this research. In order to identify technology benefits, the analysis results of integrated models were compared with those of non-integrated models. The findings indicated that the integration resulted in a cycle time reduction in bulk materials process.

However, the family of project management tools is general purpose in nature and does not include specialized software in scaling and estimating the capabilities as the cost estimating tools software does. Neither do these general project management tools deal with quality issues such as defect removal efficiency. Project management tools are useful, but software requires additional capabilities to be under full management control.

According to Rose and Suhanic (2001), today's project manager can choose from a great many computer tools. Computer-aided project management is a resource to help identify the specific job from various computer softwares, and most importantly, to help integrate computer tools in support for all the systems of project management.

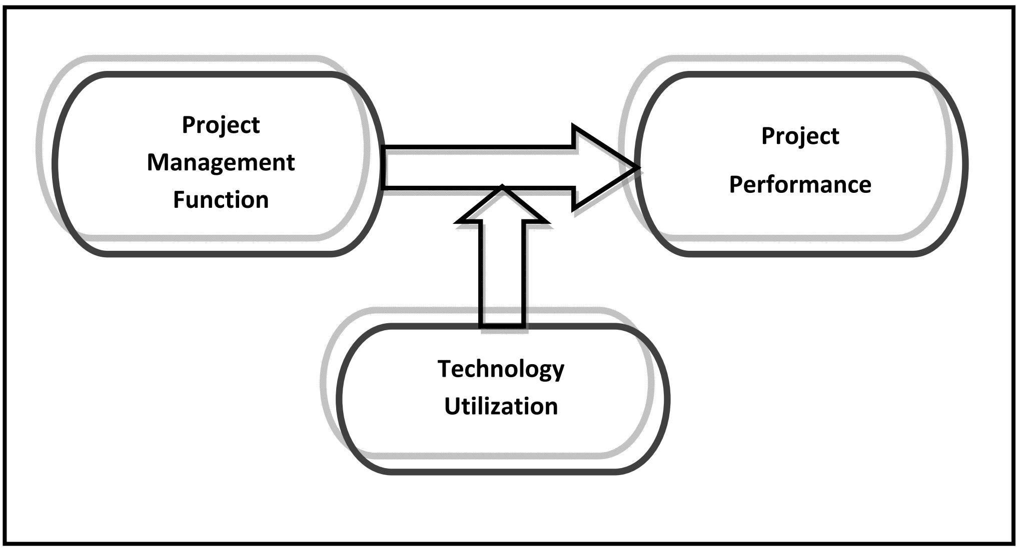
Computerization is to carry out more than the role of project management. However, making a bad schedule, cost estimate, or a portion might be equally critical to making them with manual software packages (Jiang, 2001).

3. THEORETICAL FRAMEWORK

Based on the literature review discussed in chapter two, a framework has been devised to investigate project management function of *Project Management Body of Knowledge* and technology utilization on project performance. Figure 1 depicts these relationships. This framework is derived from review on the theories, concepts and the elements involved in the project management.

This model should be viewed as the overall framework for the analysis. The independent variable in this framework is project management function. On the other hand, the dependent variable is project performance. Technology utilization serves as the intermediate between project management function and project performance in this framework.

Figure 1: Conceptual Model of the Research (Developed for This Research)



4. THE RESULTS OF ANALYSIS

4.1 The Sample of the Study

This study employed a questionnaire approach as a method of data collection. Data for this study were collected from the contractors, who represent their respective construction organizations in Aceh Province. A total of 800 questionnaires were distributed to the construction organizations. Five hundred and sixteen questionnaires were returned, 48 questionnaires could not be used because they were not completed. Therefore, a total of 468 questionnaires were collected representing 58.5 percent responses of the total questionnaires distributed and 20.05 percent of the required sample size representing 2,334 construction organizations in Aceh Province. With the approximate 20 percent data collected, responsiveness of the overall approach was considered very high standard.

4.2 Bivariate Relationship between Project Management Function and Project Performance

The correlation analysis performed in this study was to explore the strength and direction of the linear relationship between two variables. In particular, the analysis required the first objective of the study to identify the relationship between project management function and project performance variables. In determining the strength of the relationship, the 0 correlation meant no relationship; a correlation of 1.0 meant a perfectly positive correlation; and the value of -1.0 indicated perfectly negative correlation. In interpreting the value between 0 and 1, the following guidelines were proposed by (Coakes *et al*., 2009):

r =0.10 to 0.29 orr =-0.10 to -0.29: small
r=0.30 to 0.49 orr =- 0.30 to -0.49: middle
r= 0.50 to 1.0 orr =- 0.50 to -1.0: large

Table 1 shows the results of correlation analysis between the project management function and project performance examined through using Pearson product – moment correlation coefficient. The procedure targets one tailed test of statistical significance at significant level (p <0.01).In overall, the results showed that all variables of project management function and project performance was significantly and positively correlated moderately level between r = 0.165and r = 0.482. Strongest positive correlation is the relationship between integration management and time performance (r =0.482; <p 0.01).

Table 1: Correlation Between Project Management Function and Project Performance

	Integr. Man.	Scope Man.	Time Man.	Cost Man.	Qlty. Man.	HR Man.	Com. Man.	Risk Man.	Procu. Man.
Time performance	0.482 **	0.464 **	0.401 **	0.421 **	0.319 **	0.406 **	0.287 **	0.390 **	0.373 **
Cost performance	0.409 **	0.358 **	0.316 **	0.319 **	0.246 **	0.322 **	0.165 **	0.244 **	0.290 **
Quality performance	0.433 **	0.394 **	0.381 **	0.357 **	0.303 **	0.404 **	0.271 **	0.314 **	0.307 **
Stakeholder satisfaction	0.396 **	0.336 **	0.279 **	0.297 **	0.269 **	0.264 **	0.253 **	0.268 **	0.342 **

** *Significant correlation at level 0.01 (1-tailed)*

4.3 Bivariate Relationship between Technology Utilization and Project Performance

In the same way as correlation analysis of project management and project performance function, a one-tailed test of statistical significance resulted in a significance level at (p <0.01). Table 2 shows the results of correlation analysis between technology utilization and project performance. In overall, the results showed that all variables between technology utilization and project performance was significantly and positively correlated between r = 0.245 and r = 0.550. Strongest positive correlation was found in the relationship between the facility of electronic tools and stakeholders' satisfaction (r =0.555; <p 0.01).

Table 2: Correlation Between Technology Utilization and Project Performance

	Human resource expertise	Project management software	Electronic tool facility
Time performance	0.332**	0.358**	0.535**
Cost performance	0.283**	0.245**	0.509**
Quality performance	0.262**	0.270**	0.414**
Stakeholder satisfaction	0.337**	0.295**	0.555**

** *Significant correlation at level 0.01 (1-tailed)*

Analysis of correlation was performed between the three dimensions of technology utilization and overall project performance. The results also showed significant level at 0.01 (one-tailed) and a strongly positive correlation between r = 0.374 (project management software) and r = 0.648 (electronic tool facility), as shown in Table 3.

Table 3: Correlation Between Technology Utilization and Overall Project Performance

	Human resource expertise	Project management software	Electronic tool facility
Project performance	0.391**	0.374**	0.648**
Significance (1-tailed)	0.000	0.000	0.000

** *Significant correlation at level 0.01 (1-tailed)*

5. DISCUSSION AND CONCLUSION

5.1 Discussion

The first purpose of this study was to identify the relationship between the project management and project performance functions. The dimensions of project management function and those of project performance are positively related with the value of correlation ranged between r = 0.165 to r = 0.482.

These findings are consistent with the studies conducted by several researchers such as Morris(2001), *Project Management Institute* (1996; 2000) which classified the nine functions of project management: integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, procurement management. And, a significantly positive relationship between the nine project management functions and the project performance in construction organizations is in line with several studies; among others are Pinto & Slevin (1989); Jiang, *Gary & Joseph* (1996); Turner (1999); Cooke-Davies (2001); Westerveld (2002); Diallo & Thuillier (2005); Fortune & White (2006).

Strongest positive correlation is the relationship between integration management and time performance (r = 0.482; <p0.01). This finding was consistent with a study performed by the *Project Management Institute* (1996; 2000) which stated that the integration management is the concept of project management.

The second purpose of this study was to determine the relationship between technology utilization and project performance. Correlation analysis results respectively showed that all the variables of technology utilization and project performance were significantly and positively correlated with the correlation between r = 0.245 and r = 0.550. Dimensions of electronic tools facility and stake holder satisfaction were the strongest positive correlation relationship between technology utilization and project performance (r =0.555; <p 0.01).

The results of this study also affirmed support for the relationship between technology utilization and project performance. Findings showed that the three elements of technology utilization were not universally applicable to all countries. It was known that each organization was set in particular environments which were closely connected, and this environment assumed a context of technology utilization that influenced the organizations and project performance (Nabli & Nugent, 1989). However, the overall findings showed that technology utilization was an important factor in building adventageous competition among contruction organizations in Aceh Province.

This research also incorporated many past studies measuring the variables of project management functions; technology utilization and the project performance. Analysis of these measurement factors susggested a new factor in national-scale context where the research was done. Thus, this measure also increases the knowledge for future research on the project management, technology utilization and project performance functions in Aceh Province.

5.2 Research Directions for Future

To overcome the limitations, this study has thrown a lot of questions that require future research. More studies should be done to determine the influence of changes over a longer period of time in terms of project management functions and technology utilization. Therefore, future studies should consider longitudinal studies to check how a construction organization applies project management and technology utilization functions, and how they affect project performance.

Because this study used quantitative techniques in terms of the design and analysis, information collected was limited to questionnaire responses. The use of qualitative techniques should be included in future studies, because this approach gave us insight and understanding of the problems and the procedure. The study will be more meaningful if both quantitative and qualitative techniques are used because they can complement each other.

The sample was limited to construction companies in Aceh Province. Future studies should consider applying this study in other countries, especially on moderate impact of technology utilization factors. In addition, further research is also needed in other sectors or industries other than construction sector. This research will help generalization the findings in a wider context, or a comparative analysis will increasingly improve the understanding of project management functions and the use of different technologies.

The results of this study have implications on to practitioners and academics. The implications serve as a backup to the contractor and a contribution to knowledge for academic experts. For academics, needs to be done to build relationships to benefit the overall project management. For the practitioners, in the search for benefits of the project, should not depend only on specific management techniques but also on some important management techniques for organizational survival and project performance.

5.3 Summary

PMBOK which was published by the association of project management has become of great importance and been widely used by practitioners of a company and served as a best-practice guide. Several studies have identified that the function of project management is a powerful resource and a core competency that continue to be widely recognized throughout the industry.

Evidence from this study showed that the highest level of practice-related project management functions with the highest level of project performance. However, the individual dimension of the project management function contributes strongly to specific project performance variables. For example, organizations that want to apply the practice of project management function should consider integrating the management with time management.

Evidence extracted from this study showed that the technology utilization is important for construction organizations. The level of technology utilization practices is correlated to the level of project performance. However, the individual dimensions of technology utilization contribute strongly to the variable of project performance. For instance,the useof electronic tools facility with stakeholder satisfaction needs to be considered by the projects in carrying out technology utilization in construction organizations.

However, this study confirmed that the project management function was also a determining factor for successful construction in Aceh Province. The research supported that the overall project management function was positively related to the project performance.

Therefore, construction organizations in Aceh Province should strive to become a project management that will benefit the organizations from the project management function. Special attention should be given to a particular activity for the dimensions of project management functions which are related to the variable of specific project performance.

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