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# The Validation of Project Management Reference Framework Using Rasch Model

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ABSTRACT

*A project management reference framework has been developed to deal with the scarcity of a commonly recognized term of reference for Malaysian public project management. The development of this framework was instigated by the lack of terms of reference for the practice to generate the key competencies that public project managers should acquire. In this study, a working framework has been validated using the RASCH measurement model to see whether the construct identified is fit to be included within the framework. A Questionnaire survey has been used for data collection. The sample chosen was from G7 construction companies registered with CIDB and government organizations involved with construction projects. Data has been analyzed using dimensionality test and item fit testing. Through the analysis, the construct, which consists of twenty-four significant activities, has been identified to be included in the five major phases of the project lifecycle, namely the inception stage, design stage, tendering stage, construction stage, and closeout stage. With this analysis, a working Project Management Reference Framework has been validated and hopefully beneficial to the industry's practitioner.*

*Keywords: Project management; Reference Framework; RASCH Measurement Model*

## INTRODUCTION

Project management is a discipline that can be found and practiced in almost every field. The critical knowledge area within project management can be used and applied in different settings and projects. This knowledge has been captured and standardized by associations and organizations committed to maintaining the practice's professionalism and credibility. From these standards, different tools and mechanisms have been developed to facilitate the use of these standards.

The project manager or project director more or less influences the application and utilization of these tools and standards in projects. The use of project management tools can significantly enhance project performance and managing the project team in a structured manner. However, for the public projects, managing the projects and the project teams is still unsatisfactory, and it is questionable whether the person managing the project is capable enough.

Reports can be seen in the Auditors General Reports every year, which highlighted the poor performance of public projects. One key finding stated that the competencies of the project manager are in question. This has raised public concerns over the government's credibility in undertaking the public interest. In order to revamp the practice and improve public opinion, a structured and holistic approach needs to be taken to develop competent

public project managers. In doing so, the critical competency area needs to identify in order to train the project managers.

This framework can assist in identifying the critical area that needed to be focused on and formulate the structure of training programs. This framework is still in its development stage, and through the validation process, the framework is hoped can be an excellent tool to assist the practice in moving forward.

## THE DEVELOPMENT OF THE REFERENCE FRAMEWORK (RF)

The development of RF consistently links with improved processes (Conradi, Fernstrom, Fugetta, & Snowdon, 1992; Franceschini, Galetto, Maisano & Mastrogiacomo 2007; Bufardi & Kiritsis 2013). Reference is defined as a source of information containing valuable facts and information. In contrast, the definition of a framework according to Merriam-Webster (2014) is a collection of ideas or facts that support something, or a reference point. Depending on the intent of the RF, the depth and level of detail may vary. It may be exhaustive or merely summarized (UNICEF 2002).

The activities within project management are complex and interrelated which any occurrence of complication on any single activity can affect the project's outcome. The susceptible characteristic of these activities means that careful and detailed planning needs to be strategies, considering the whole spectrum of project life. Therefore, an overview process map of the project management lifecycle activities must be identified and outlined as an apparatus to assist the process and easy understanding. It is only logical for such a methodological approach is to be considered since the project management itself is a process by nature.

The proposed framework is being developed, which puts in mind the visualization of the overall process of project management, which focuses primarily on complementing the principle in the Book of Knowledge (BoK) by providing a platform for mapping the knowledge and skills specified in the BoK as necessary for project management. By mapping this knowledge and skills, it can ease and assist in managing a project, such as developing a proper standard of procedures, designing proper training, and other public project-related processes.

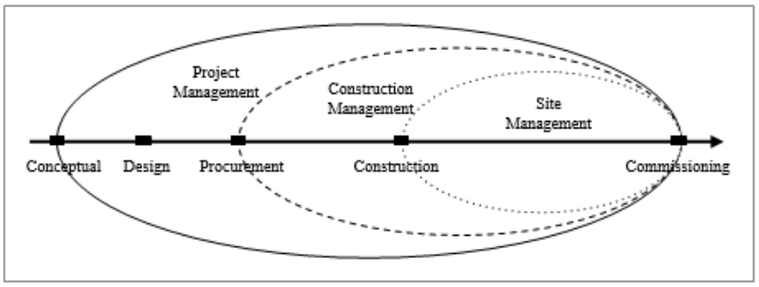


FIGURE 1. Scope of Management in Project Lifecycle
*Source*: Hassan F. P. (2005)

The notion that the critical phases of the project lifecycle consist of (i) the conceptual phase, (ii) the design phase, (iii) the procurement phase, (iv) the construction phase, and (v) the commissioning phase was derived from the frameworks established by the Royal Institute of British Architects and Project Management Institute (PMI). Griffith and Watson (2004) and Loosemore et al. (2003), Hassan (2005), and Mat Isa (2009) provided additional support. Consequently, as shown in Figure 1, the categorization of the phases and their mapping to the scope of project management, construction management, and site management are converging.

The RF does not propose a standardized framework or model for all initiatives. For each project team to evaluate its situation, define its objectives, and develop the appropriate instruments to achieve those objectives. The purpose of the RF is to provide guidance and assistance for enhancing decision-making and project management action. It is not a cure-all for all project management difficulties. The objective is also to encourage the project team to develop their own measures or actions that are most suitable for them but are not completely reflected in the RF.

## METHODOLOGY

This research makes use of a quantitative methodology using survey design, and the data collection tool is a survey form. It is an instrument that serves the purpose of establishing whether the component that was discovered to construct the framework is acceptable to the vast majority of professionals in actual practise. A questionnaire survey has been developed as a result of a literature research and validation by a panel of experts. All of the panel's recommendations have been taken into account in the process of fine-tuning the instrument. For the purpose of this investigation, a sampling strategy known as clustered random sampling will be utilised. The project managers employed in the commercial and governmental sectors, as well as the people who collaborate with project managers, make up the population chosen for the questionnaire survey. The private organisations that were chosen all have G7 ratings and are registered with the CIDB as either builders or contractors. The organisations that were chosen to represent the public sector were government and semi-government bodies that had their own internal development departments. The Klang Valley, Putrajaya, and Selangor have been included in the research since this study has been conducted in the central region of Malaysia. The location of this region was selected since it is the location of the headquarters of the most prestigious corporate enterprises as well as government and semi-government organisations. In addition to that, in comparison to the other regions of Malaysia, this region has the most development projects. Furthermore, the majority of the project types that are being built in Malaysia can be found in this region, and the procedures are the same as those in other states. As a consequence of this, the statistics gathered from this region are considered to be adequate and reflective of the population as a whole.

## FINDINGS

### CONSTRUCT VALIDITY (DIMENSIONALITY TEST)

The dimensionality test is used to determine if the activities measure the same dimension, which is the dimension of the project management lifecycle. The necessary indicators for this analysis are the 'Raw variance explained by measures' and the 'Unexplained variance in first contrast.' The condition that must be satisfied is that 'Raw variance explained by measures' must be greater than 40 percent and 'Unexplained variance in first contrast' must be less than 15 percent.

TABLE 1. Table of Standardized Residual Variance for Major Activities in the PM Lifecycle

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INPUT: 116 PERSON 24 ITEM REPORTED: 116 PERSON 24 ITEM

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-

  Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

             -- Empirical -- Modeled

Total raw variance in observations  =   41.8 100.0%   100.0%

 Raw variance explained by measures =   17.8 42.6%   42.9%

 Raw variance explained by persons =   10.5 25.1%   25.3%

 Raw Variance explained by items =   7.3 17.4%   17.6%

 Raw unexplained variance (total)  =   24.0 57.4% 100.0% 57.1%

 Unexplned variance in 1st contrast =   3.3 7.9% 13.7%

 Unexplned variance in 2nd contrast =   2.5 5.9% 10.4%

 Unexplned variance in 3rd contrast =   2.2 5.4% 9.3%

 Unexplned variance in 4th contrast =   1.8 4.2% 7.3%

 Unexplned variance in 5th contrast =   1.7 4.0% 7.0%
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As shown in Table 1, the obtained result reveals that the 'Raw variance explained by measures' value is 42.6%, which is greater than 40%, and the 'unexplained variance in first contrast' value is 7.9%, which is less than 15%. According to the Rating Scale Instrument Quality Criteria (Abdulaziz, 2010), both values are categorised as acceptable. The result indicates that the activities measure the same dimension, which is the project management lifecycle. To investigate the validity of each item, an item fit analysis on each item has been done. The findings are as reported in the next section.

## CONFIRMING THE PROJECT MANAGEMENT MAJOR ACTIVITIES IN THE PROJECT LIFECYCLE (ITEM FIT)

This reference framework proposed five major phases, as can be found in the project lifecycle. Within these phases, there are major activities that we consider as the primary construct. There are several items identified to measure each of these constructs. The numbers of items are as listed in Table 2.

TABLE 2. Project Phase, Construct and Number of Items

| Project Phase | Major Activities (Construct) | No of Activities (Items) |
|---|---|---|
| Inception Stage | Initiation | 4 |
| | Planning | 9 |
| | Feasibility studies (Macro level) | 3 |
| | Consultant appointment | 6 |
| | Clients' brief | 6 |
| | Site visit and investigation | 5 |
| | Conceptual design | 4 |
| | Preliminary estimate | 5 |
| | Budget allocation | 5 |
| Design Stage | Scheme design | 5 |
| | Detail design and specification | 6 |
| | Factor estimate | 4 |
| | Control estimate | 5 |
| | Authorities requirements | 3 |
| Tendering Stage | Tender documentation | 2 |
| | Tendering exercise | 6 |
| | Tender receipt and evaluation | 6 |
| | Tender award | 5 |
| Construction Stage | Contract administration | 9 |
| | Project monitoring | 14 |
| Close Out Stage | Testing and commissioning | 5 |
| | Defect liability period management | 6 |
| | Handing over exercise | 6 |
| | Project close out | 11 |

To affirm whether the construct is suitable for inclusion in the framework, an analysis of item fit has been conducted. As shown in Table 3, an item fit analysis was conducted to demonstrate that each activity is suitable for inclusion in the framework based on three underlying criteria. When evaluating suitable items, at least one of the criteria must be met (Abdul-Aziz, 2010). If the values are met, it is determined that the activities are suitable for inclusion in the framework.

TABLE 3. Criteria for Considering Outliers and Misfits Item

| Criterion | Acceptable Rating Scale |
|---|---|
| 'Point measure correlation' (PTMea Corr) | 0.4 < PT-MEASURE CORR value < 0.85 |
| 'Outfit Mean Square' (MNSQ) | 0.5 < MNSQ Value < 1.5 |
| 'Outfit Z-standard' (ZSTD) | - 2 < ZSTD value < +2 |

*Source*: (Abdul Aziz, 2010)

The item fit analysis begins with an examination of the inception stage activities, which include initiation, planning, feasibility studies, consultant selection, client brief, site visit and investigation, conceptual design, preliminary estimate, and budget allocation. The test determined whether each activity is suitable for inclusion in the framework as depicted in Table 4.

TABLE 4. Inception Stage Activities Item Fit Testing

| No. | Activities | PT-MEA CORR | MNSQ | ZSTD | Fit/ Unfit |
|---|---|---|---|---|---|
| | | 0.4 < x < 0.85 | 0.5 < x < 1.5 | - 2 < x < +2 | |
| 1 | Initiation | 0.63 | 1.19 | 1.3 | Fit |
| 2 | Planning | 0.63 | 0.69 | - 1.7 | Fit |
| 3 | Feasibility studies (Macro level) | 0.67 | 0.96 | - 0.2 | Fit |
| 4 | Consultant appointment | 0.60 | 1.50 | 3.0 | Fit |
| 5 | Clients' brief | 0.65 | 0.8 | -1.2 | Fit |
| 6 | Site visit and investigation | 0.58 | 1.02 | 0.2 | Fit |
| 7 | Conceptual design | 0.58 | 0.9 | 0.6 | Fit |
| 8 | Preliminary estimate | 0.65 | 0.82 | -1.2 | Fit |
| 9 | Budget allocation | 0.54 | 1.06 | 0.4 | Fit |

It has been established, based on the findings presented in Table 4 of the analysis, that the tasks determined at the inception stage are suitable for incorporation into the framework. However, one of the qualifying values for the 'Consultant Appointment' does not fall within the range of the parameters that have been provided. The reason for this disparity is that project teams very infrequently take care of consultant appointment scheduling. They are only able to offer their ideas and suggestions regarding the topic; ultimately, the decision rests with the senior management. Following this, an item fit analysis was performed on the activities that were determined during the design stage. The activities include the design of the scheme, the design of the details and specifications, the estimation of the factors and controls, and the needs of the authorities. Table 5 presents the findings of the investigation.

TABLE 5. Design Stage Activities Item Fit Testing

| No | Activities | PT-MEA CORR | MNSQ | ZSTD | Fit/ Unfit |
|---|---|---|---|---|---|
| | | 0.4 < x < 0.85 | 0.5 < x < 1.5 | - 2 < x < +2 | |
| 1 | Scheme design | 0.67 | 0.83 | -1.1 | Fit |
| 2 | Detail design and specification | 0.53 | 1.96 | 4.3 | Fit |
| 3 | Factor estimate | 0.67 | 0.89 | -0.8 | Fit |
| 4 | Control estimate | 0.62 | 1.09 | 0.6 | Fit |
| 5 | Authorities requirements | 0.49 | 1.30 | 1.7 | Fit |

The primary activities that were identified during the design stage have the potential to be included in the framework based on the results of the analysis presented in Table 5. However, one of the outcomes for the detail design and specification criteria does not fall within the parameters that have been specified. This disparity exists since consultants, specifically architects, are typically responsible for managing this activity. However, this activity is necessary for the administration of the project, and the public representative needs to be involved in this activity to some degree in order for the project to be successfully managed. The actions that took place during

the tendering stage were afterwards identified using the item fit analysis. Tender documentation, tender exercise, tender receiving and evaluation, and tender awarding are the activities that make up these activities. The outcome is presented in Table 6.

TABLE 6. Tendering Stage Activities Item Fit Testing

| No | Activities | PT-MEA CORR | MNSQ | ZSTD | Fit/ Unfit |
|---|---|---|---|---|---|
| | | 0.4 < x < 0.85 | 0.5 < x < 1.5 | - 2 < x < +2 | |
| 1 | Tender documentation | 0.54 | 1.09 | 0.5 | Fit |
| 2 | Tendering exercise | 0.63 | 0.87 | - 0.8 | Fit |
| 3 | Tender receipt and evaluation | 0.62 | 0.72 | - 1.6 | Fit |
| 4 | Tender award | 0.58 | 1.01 | 0.1 | Fit |

According to the findings shown in Table 6 of the analysis, the primary activities that were determined during the stage of tendering can be incorporated into the framework. The actions that took place during the construction stage were afterwards determined by the item fit analysis. The activities include monitoring of the project as well as administration of the contracts. Table 7 presents the results of the analysis.

TABLE 7. Construction Stage Activities Item Fit Testing

| No | Activities | PT-MEA CORR | MNSQ | ZSTD | Fit/ Unfit |
|---|---|---|---|---|---|
| | | 0.4 < x < 0.85 | 0.5 < x < 1.5 | - 2 < x < +2 | |
| 1 | Contract administration | 0.57 | 0.98 | - 0.1 | Fit |
| 2 | Project monitoring | 0.48 | 1.04 | 0.2 | Fit |

The conclusion that can be drawn from the findings of Table 7 of the study is that the primary activities that were identified during the construction stage can be included in the framework. Following that, the item fit analysis uncovered the activities that took place throughout the close-out phase. The operations include testing and commissioning, management of the defect liability period, a handing over exercise, and the closure of the project. The outcome is presented in Table 8.

TABLE 8. Close Out Stage Activities Item Fit Testing

| No | Activities | PT-MEA CORR | MNSQ | ZSTD | Fit/ Unfit |
|---|---|---|---|---|---|
| | | 0.4 < x < 0.85 | 0.5 < x < 1.5 | - 2 < x < +2 | |
| 1 | Testing and commissioning | 0.55 | 1.17 | 0.9 | Fit |
| 2 | Defect liability period management | 0.66 | 0.94 | - 0.4 | Fit |
| 3 | Handing over exercise | 0.65 | 0.89 | - 0.7 | Fit |
| 4 | Project close out | 0.67 | 0.86 | - 0.9 | Fit |

According to Table 8 of the analysis, the primary actions that were determined during the close-out stage can be incorporated into the framework. As a consequence of the findings of this analysis, the activities that have the potential to be incorporated into the framework have been validated. Figure 2 depicts the emergent framework, which was formed as a result of these findings as well as the input received from the preliminary interviews.

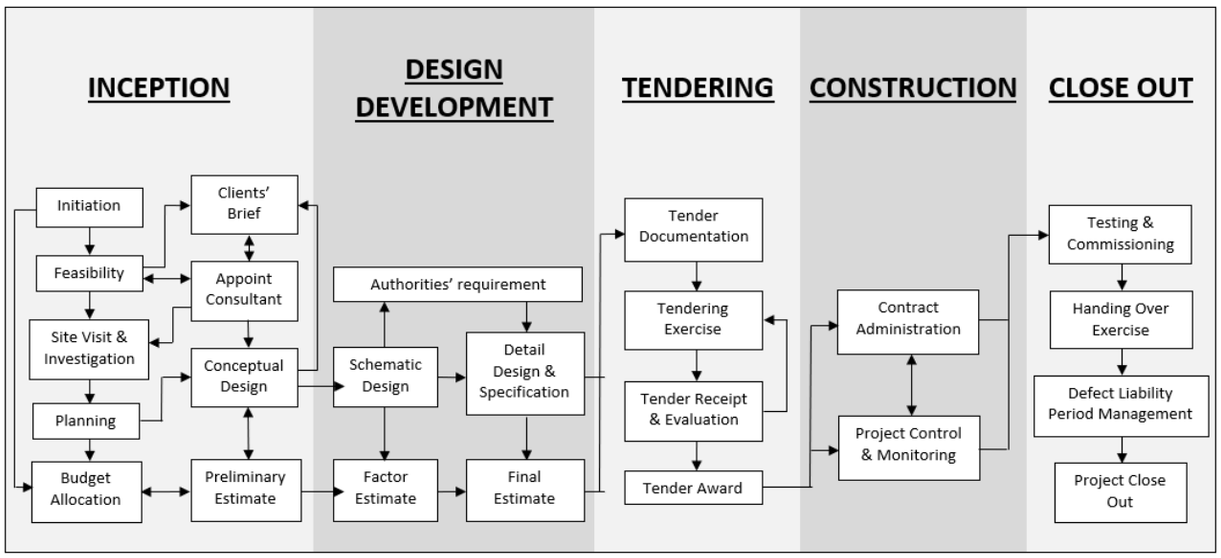


FIGURE 2. Project Management Reference Framework

## CONCLUSION

After conducting an inquiry on the availability of the most recent project management reference framework that is put to use by public project management practises, we decided to get started on this line of research. The findings, which are inconsistent with one another, indicate that there is an inadequate amount of universally recognised RF within the public practise. According to the data, the prevalent method is already compliant with the worldwide standards that are being developed by the worldwide Association for Project Management. research after research demonstrates that using this standard does not guarantee that a project will be successful, despite the widespread belief that the modifications made to this standard are enough. As a result, building a comprehensive RF that is in line with the local practise, culture, policy, and regulations necessitates taking into consideration a method that is both structured and strategic.

From this study, a comprehensive RF has been validated that could serve as a tool to map the international standards' principle-based approach. It provides a practice-based approach to managing projects. Through the analysis, the major activities have been identified and validated by the industry practitioner. A commonly accepted practice-based RF has been developed to fill the gap in the industry through this validation.

The lack of generally accepted RF within the public project management practice has inflicted unnecessary impairment on public credibility and image in delivering a quality development in a timely and cost-efficient manner. These are caused by issues that arise within the project practice, which comprises lacking in the coordination of works, insufficient personnel competencies, improper planning, etc. The recurring issues seem endless, and it has been identified that an absence of a commonly accepted RF has contributed to these issues. The absence of such RF has fundamentally affected the public project management practice, especially in its SOPs, contributing to the issues. It has been identified that the available SOPs need to be realigned and improved for the better conduct of projects.

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