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Multi Structures-Scales (MSS) in Project Execution Management (PEM)

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Abstract

This research study focuses on project organization structure, multi-tasking, issues, challenges, and limitations that occur during the project execution for a conventional and virtual team. This research aims to understand the importance of the technical labor force in the organization and fill the human resources gap in project engineering, construction, and management implementation. The project is unique and must be dealt with highly technical by the project team. Projects might be the same structure and scale but in different conditions, parameters, and requirements. In general, dealing with and executing other projects is challenging. The design guidelines are formatted, although not entirely the same. The process model uses model-based optimization to compare the conventional and virtual MSS organizational structures to optimize, innovate, and multi-tasking project staff, personnel, and direct technical members. The study will include the importance of global virtual teams (GVT) and the contribution of software collaboration, including cloud-based software (CBS). Multi structures-scales (MSS) concept can be a diversified, optimized, and innovative way to increase team effectiveness, technical dependence, and utilize existing resources. It uses organizational productivity and the individual living of project team members. However, even though the MSS concept seeks to lower the labor cost and reduce individual participation, the labor issue, technical workforce, challenges, disputes, and other problems are not inevitable. As a result, in this implementation, the corporate organization will solidify the project team structure into multi-project execution even to long-term employment and operation. The PE/S can perform simultaneously in different stages of the same type of project. In contrast, a PM can perform additional steps even on other kinds of projects. Furthermore, in the study, PS and PM can effectively function if not more than three (3) projects; otherwise, low-performance evaluation and low-quality product results occur. In this regard, further study and research related to this

topic for better implementation in the field.

Keywords

CBS, MSS, Functional Structure, GVT, Virtual Teams

1. Introduction

The oil & gas, petroleum refinery, petrochemical, and L/NG treatment process plant projects are categorized as complex projects, including organizational structures and corporate business deals. Furthermore, in Southeast Asia, sustainable infrastructure projects are increasing rapidly.

This study focuses on involvement in the project and cultural diversification. This concept emphasizes that the project managers/director (PM/D) and project engineer/scientist (PE/S) are the key people to play in the multi-tasking execution of the project. It's a factor where the combination of traditional and VPM operation is in collaboration with software innovation to attain the multi structures-scale (MSS) in the execution of the project. The concept somehow profitability and opportunity are always at the doorframe in the business arena. However, it's risky; the unpredictable tasks and sometimes re-structured technical personnel create organizational complexity and cultural disputes. Conflicts and disagreements are always present, mainly in the execution stage, due to misunderstandings and misinterpretations such as technical, state regulations, and communication barriers (Cripe & Burleigh, 2022). Building a project team is demanding and challenging, even for a virtual team (Daim, 2012). A competitive and effective project team lies in the leadership style of project managers, good relationships, and performance (Kaufmann & Kock, 2022), as follows.

This research emphasizes the importance of the MSS concept nowadays and utilizes workforce resources, including a virtual team. However, further research is required primarily for a specific application.

2. Conceptual Framework

The research study framework focuses on the project's organizational structure and scales within **Figure 1** and **Figure 2** as described in EMBOK (ASEM, 2019), PMBOK (PMI, 2021), and the project stages in the construction sector as described in **Figure 1** and **Table 1**. In addition, it will be checked the PM's opinion and analysis. Since this concerns the output efficiency and performance conducted regularly. Work success is measured by the result rather than by position or political post (PMI, 2021).

It's mentioned in **Figure 1** that the project execution stages and the multi-tasking combination with the MSS concept can be integrated as one (1) solidified team member in the organization. Depending on their capabilities, expertise, and experiences, the entire project team is classified as conventional and GVT.

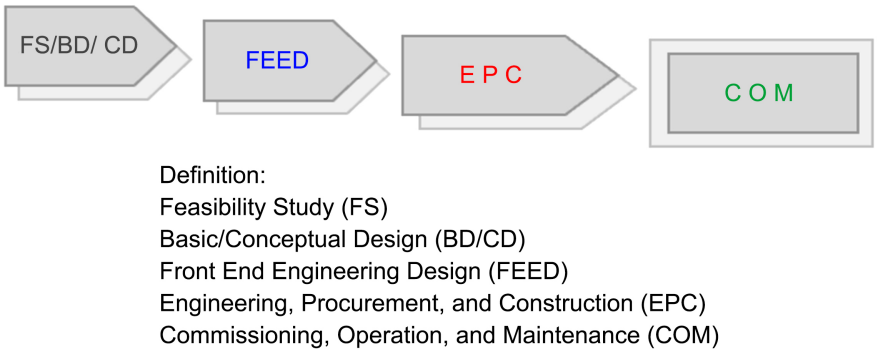


Figure 1. The stages of project execution.

Table 1. Type of projects and PM handling.

Item	Project Description	PM	Volume, (MT)	Cost, (US$)
P-1	Oil & Gas (Upstream, Rig Platform)	P1 (a/b)	V-2	C-9
P-2	Oil & Gas Treatment Plant	P2 (a/b)	V-8	C-6
P-3	Wastewater Plant	P3	V-4	C-2
P-4	Power Plant	P4	V-3	C-3
P-5	Petro Refining Plant	P5	V-9	C-8
P-6	Petro Chemical Plant	P6	V-5	C-4
P-7	LNG(a)/LPG(b) Processing Plant	P7 (a/b)	V-7	C-7
P-8	LNG(a)/LPG(b) Receiving & Regasification Plant	P8 (a/b)	V-6	C-5
P-9	Other Sectors	P9	V-1	C-1

Notes: [1]Bulk project in terms of volume (highest 9, lowest 1), Metric Ton (MT); [2]A massive project in terms of billion dollars (highest 9, lowest 1), US Dollars (US$); [3]Not the same person (PM) in typical structures of handling projects.

3. Literature Review

As described in the book of knowledge, PMBOK (PMI, 2021) and EMBOK (ASEM, 2019), the typical structure is shown in **Figure 2**. With this pattern, the corporate perspective's Multi-Structure and Scale (MSS) concept can adequately utilize and organize the existing team with their expertise without adding the workforce significantly. However, the technology complex, time-consuming, high cost, and lack of knowledge transfer are the main issues faced even in virtual teams (Alnsour, 2014). In this regard, techniques in project management (Fisher, 2014) are essential to these changes' impact (Gamage, 2016). Furthermore, suppose in case an additional workforce is required. In that case, a virtual team is the best option (Crayon et al., 2017), and exceeding person-hours is another option if there are no qualified personnel who can fill in the position (Behling, 2019; Beise et al., 2010).

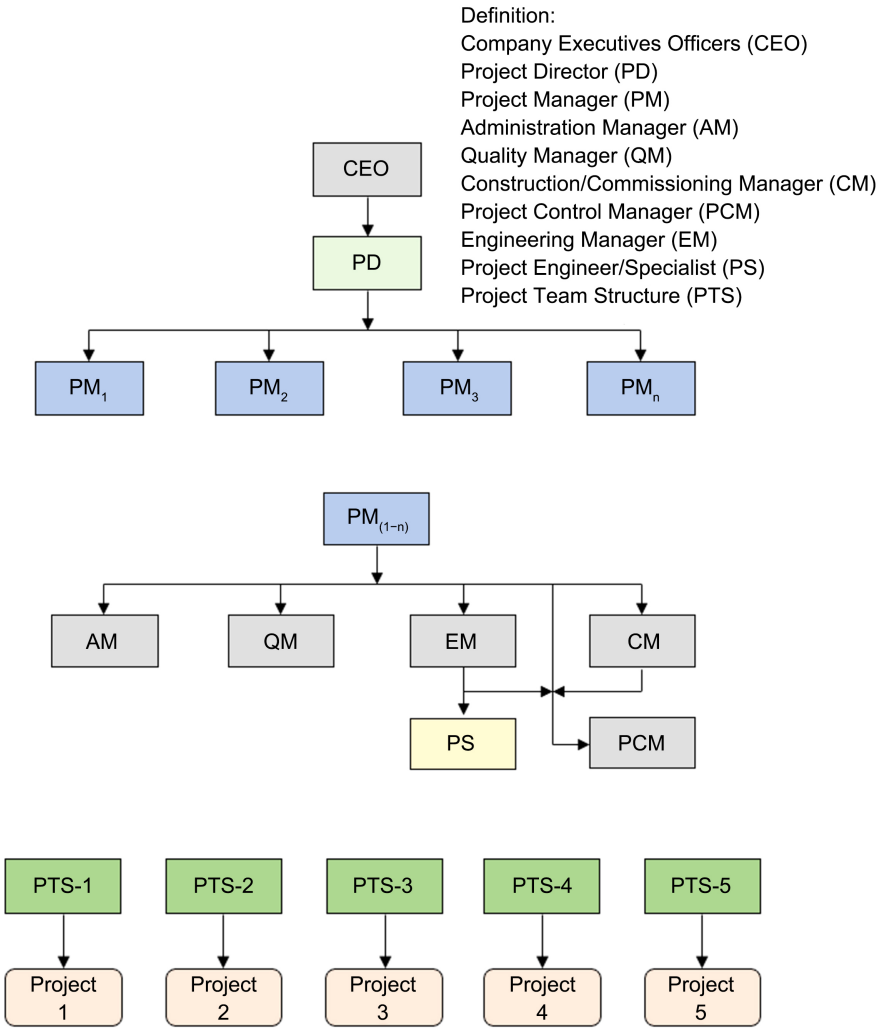


Figure 2. Conventional project structures.

However, fear (Casey & Richardson, 2008) and untrust (Casey, 2010) are the hindrances and factors to limit outsourced staff including virtual personnel, especially overseas (Dumitrascu & Dumitrascu, 2016). Furthermore, there is no difference between a virtual team and real team requirements (Christopoulos et al., 2016). The completion and performance matter (McLarnon et al., 2019), and the submission of deliverables is more critical.

4. Significance of the Study

The objective of this research is to understand the importance and values of the technical labor force in the organization and to fill the human resources gap in project engineering, construction, and management implementation. Although this is not the solution, the suggestive points were discussed to prevent misconceptions about this research. The organizational models and structures, such as functional structure, project-based organizations, and matrix structure (PMI, 2021; ASEM, 2019), are very significant in business organizations, specifically in

project engineering and construction. With this concept, Multi-Structure and Scale (MSS), the business corporate can adequately utilize and organize the existing team with their expertise without adding significantly. It allows the corporate management a longer preparation time for finding qualified personnel if necessary. The application might defer depending on the project location and local team members, including the global virtual team (GVT). However, the multi-structure and scale concept can be applied at any project stage described in **Figure 1** and type for project managers, directors, engineers, specialists, and field experts with diverse differences and processes. It considers both face-face and virtual working environments.

In most projects, the Project Director (PD), Project Manager (PM), Project Engineer (PE), and Project Specialist (PS) are the top, highlight, and hold the fundamental rules of engagement for a successful project. In **Table 1**, the types of projects are indicated, and in most cases, the PM, PE, and PS will perform depending on their capability, depth of experience, and specialty. In the conventional approach, many of the projects handled are not the same person (project manager) who served in the project, as indicated in **Table 1** and **Figure 2**. The conventional project organizational structure thought by EMBOK (ASEM, 2019) and PMBOK (PMI, 2021) Guide, such as functional, project-based, and matrix structures, is the base of this research. In addition, the concept emphasizes the importance of team member utilization, performance evaluation, and strong communication.

Although, the researcher emphasizes the sectors that apply in this research as described in **Table 1**, however, there are no limitations, it depends on the evaluator, executor, implementor, etc. having full responsibility for using this MSS Concept in a particular application since this is only based on the researcher's observation. Further, the kin of this study will concrete and solidify the MSS Concept in the specific application. Moreover, the researcher suggested and levelized the complexity and difficulties in the following tables and discussion.

5. Methodology

This research has two methods to perform this conceptual analysis. First, it will check and evaluate the simple model analysis from **Figure 2** converted to **Figure 3** using the PEA, PMP, & REST (PPR) method. Second, to ask the expert's opinion in the field and, given the model structure from **Figure 2**, will analyze a project manager's (PM) performance, estimating load directly proportional to effectiveness in handling projects. The survey data will use for the simple model analysis. Assume the project team, mainly the project managers will configure the layout to deal with the project, as shown in **Figures 3-7**. The researcher will survey PM's opinions and capacity regarding the depth of their experience in these industries. Then, the re-structure and configure the project organization and organize the virtual team (vT) and data management system will help the PM maximize the capacity to handle the project.

6. Model Analysis

This process will check the expert's opinion in the field, and the given model structure from Figure 2, will analyze a project manager's (PM) performance, estimating load directly proportional to effectiveness in handling projects. Project team structures (PTS) are composed of PM and functional experts.

Assume the project managers will configure the layout to deal with the project, as shown in Figure 3, Figure 5, Figure 6, and Figure 7. The researcher will survey PM's opinions and capacity regarding the depth of their experience in these industries. The re-structure and configure the project organization and organize the virtual team (vT) and data management system will help the PM maximize the capacity to handle the project.

There are three (3) areas to consider in the model: to allow and understand the capability of the project manager and the other functional discipline team (Ybañez, 2017).

- Performance Evaluation and Analysis (PEA)
- Principle, Methodology, and Procedure (PMP)
- Reliabilities and Strategies (REST)

Performance Evaluation and Analysis

Performance Evaluation and Analysis (PEA) is neither annual nor monthly checking and evaluation per project accomplishment.

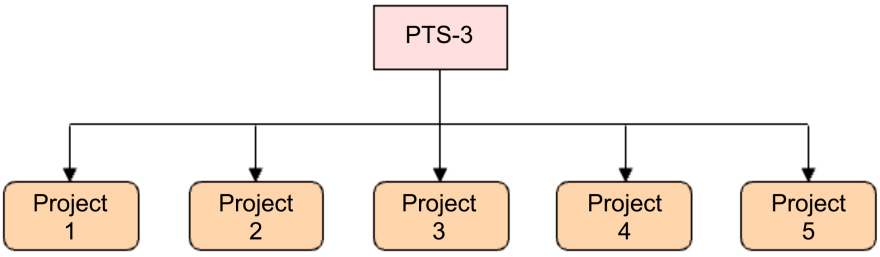


Figure 3. Multi-task full-scale. Project Team Structure (PTS).

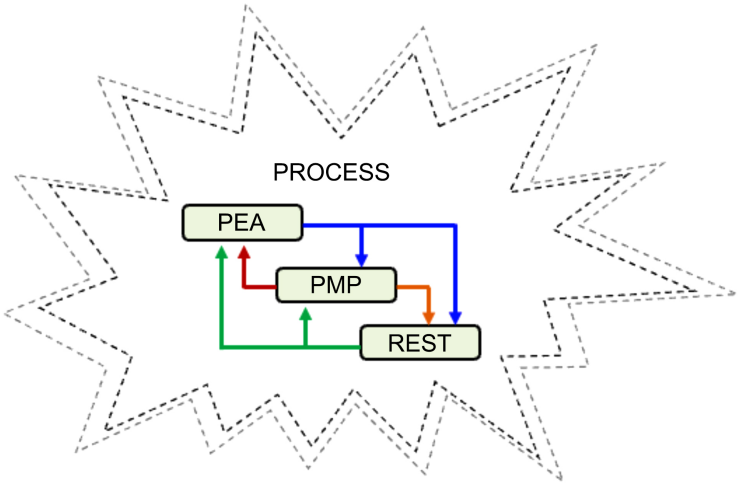


Figure 4. PEA, PMP, & REST (PPR) model analysis.

For virtual project management (VPM), the success or failure of every project was credited to the project contractor. However, the virtual platform may not be affected due to the nature of the operation. On the other hand, the continuous relationship between the project and the VPM team may be affected or, to worst come, disconnected. So, the PEA concept will apply even though the virtual environment. All project team members must undergo this appraisal per project.

Principle, Methodology, and Procedures

Principle, Methodology, and Procedures (PMP) is a fundamental concept of the virtual environment as part of the orientation stage for new vT members. It will allow and help the Project Company/Owner to understand the virtual set-up and technical project member by using the form of a checklist of performance evaluation.

The project's cost may decrease, and the Project Company/Owner may be aware of the set-up if the virtual environment is introduced. However, the Project Contractor is liable and responsible for this virtual set-up and function throughout the project execution (Ybañez, 2017).

Reliabilities and Strategies

Reliabilities and Strategies (REST) is an approach to qualify the model and consistency of an operation with minimal errors. However, the virtual environment may give higher inconsistency if the model test fails during the dry-run operation of any virtual devices (Ybañez, 2017).

To improve the system's reliability, conduct a strategic plan, and implement each function regardless of the system's consequences. However, this only happens when no or less design in the virtual environment; reliability approaches will help to understand and avoid the misconception of the system.

The following three (3) essential elements of reliability approaches,

- Identify and prevent the occurring problem.
- Range and tolerance of errors/faults.
- Repair and recover from possible failures.

6.1. Multi Structures

In most practice, the project manager can perform effectively in not more than one (1) project.

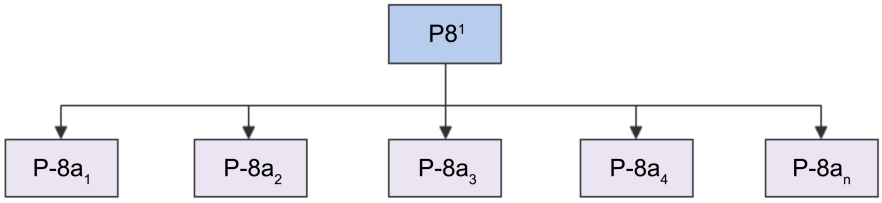
Case-1.1: *Same PM - P*8 *Handling same Type of Project* (*P*-8*a*)

Considering the project team and project manager (PM) performing multiple projects in the same stage and type of project, refer to **Figure 1** and **Table 1**. See **Figure 5**.

Case-1.2: *Same PM - P*8 *Handling Different Types of Projects* (*P*-8*ab*)

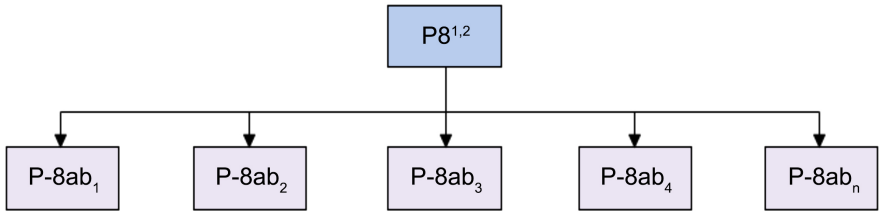
Considering the project team and project manager (PM) performing multiple projects in the different stages and types of projects, refer to **Figure 1** and **Table 1**: Type of Projects and PM Handling. See **Figure 6**.

However, through surveys, process improvement and innovative system structure will be possible with software collaboration and confirmation of expert project



Notes: [1]The same person (PM) is simultaneously performing or handing the same type of project.

Figure 5. Case-1.1.



Notes: [1]The same person (PM) is simultaneously performing or handling the same type of project (P-8ab); [2]The project team and PM can perform both a/b of P-8a/b projects, LNG, and LPG Regasification Plant. These projects are interrelated (much closer) to each other.

Figure 6. Case-1.2.

managers around the industries. Assuming this project will be executed at the same stage as shown in **Figure 1**.

In **Table 1**, the P7 and P8 are the most prolonged construction duration in most tasks due to the LNG Tank construction minimum of almost 24 months. As a sample of this analysis, in Case-1.1, 1.2, and 1.3, the project team and Project Manager (PM) in P8 and P7 project types refer to **Table 1**.

Case-1.3: *Either PM - P7 or P8 Handling Different Types of Projects* (*P-7a and 8a*)

Considering the project team and project manager (PM) performing multiple projects in the different stages and types of projects, refer to **Table 1**: Type of Projects and project manager Handling. See **Figure 7**.

As shown in **Table 2**, the level of each case in terms of complexities/difficulties is in proportion to the conventional set-up, one project for 1 project manager (PM). The ratio will be compared to the survey result, three projects per 1 PM. In **Table 2**, the estimated mean level of cases 1.1, 1.2, and 1.3 compared to conventional and surveyresults. Considering the complexity margin of 10%, 20%, and 30% for each project, assume 3 - 5 projects.

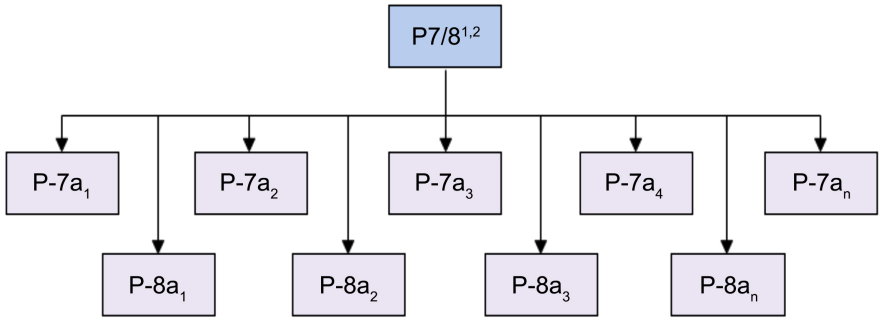
In this evaluation, the performance of the project team and project manager may affect the production or result due to the degree of complexities and difficulties.

However, in **Figure 8**, if the linear relationship between complexities/difficulties (loads) and rewards/bonuses (monetary), performance in terms of completion and efficiency might increase proportionally.

Table 2. Estimated Level of Complexities/Difficulties (LCD)[1].

LCD	Conv.	Case 1.1	Case 1.2	Case 1.3
Low	☐	☐		
Medium			☐	
High				☐

[1]Detail value shown in **Table 5**, mean value only.



Notes: [1]The same person (PM) performing or handling the same type of projects (P-7a & 8a) at the same time, take note of P7> P8 (referring to the degree of difficulties and experiences); [2]The project team and PM can perform P-7a & 8a projects, LNG Liquefaction, and Regasification Plant.

Figure 7. Case-1.3.

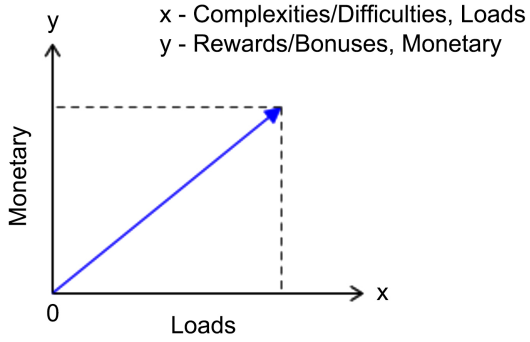


Figure 8. Load-monetary relationship.

6.2. Multi Scales

The capacity and type of project are the constraints of milestone duration, the cost may sometimes affect it, but those sizes are most likely to happen. The scale refers to the capacity, including the price, considering the same type of project.

The researcher chose the LNG project as a model sample for this analysis. The LNG project is longer than other types of projects due to LNG Storage Tank construction; the higher no. of units, the longer it takes. Refer to **Table 1**.

In the past decade, due to the high peak construction demand in Qatar, LNG Plant construction, including the vast number of LNG Storage Tanks, takes up to 2 - 4 years.

Same Type of Project (*P*-8*a*)

Considering the project at the same stages and level, refer to Figure 1 and Table 1. In Figure 9 below, the capacity-cost concept linearity is profiled in the Project.

Different Types of Projects (*P*-7*a* & 8*a*)

Considering the project at the same stages and level, refer to Figure 1. In the graph below, the capacity-concept polynomial is profiled due to factors variance of the Project.

Figure 10, referring to Table 1, shows the cost-volume graph for the typical projects. The cost and volume vary depending on the type of project; some projects' budgets tremendously, and some are mean likewise in volume, assuming P-7a/8a.

In Figure 9, Figure 10, and Figure 11, the capacity-cost graph shows an effect of change when factors came along the way of the project. Factors categorize depending on location, configuration, and material to use in the project.

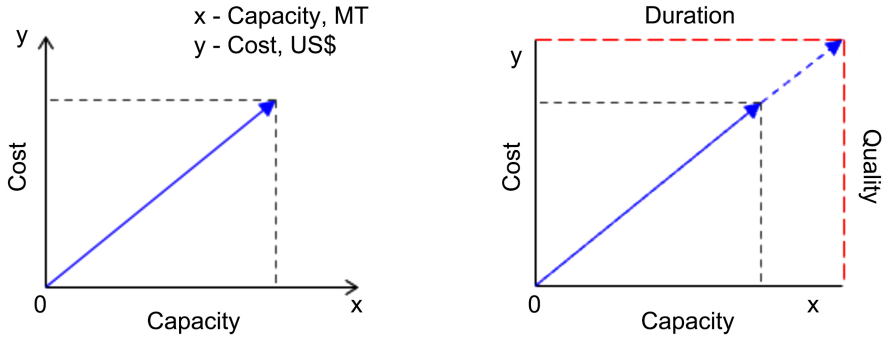


Figure 9. Capacity-cost concept of the project.

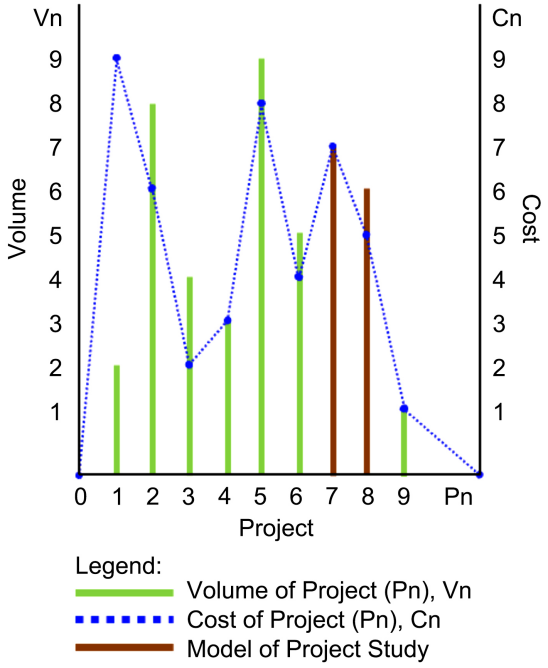


Figure 10. Cost-volume graph for all project.

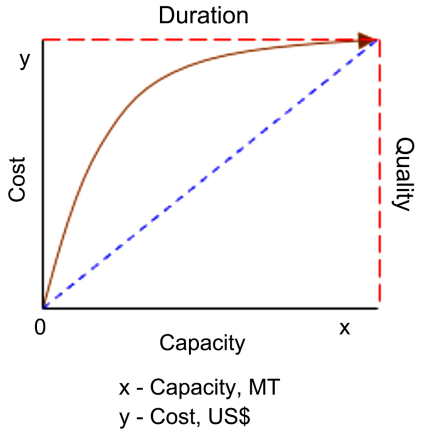


Figure 11. Capacity-cost graph with factor variance (P-7a/8a).

The project manager (PM) can manage even though that condition and situation occur during execution.

7. Results and Discussions

In the project execution management (PEM) system, the multi-structure and multi-scale focus on the PM capabilities and experiences of the project team structures (PTS), as shown in **Table 3**.

Survey Question (SQ): As PM, how many (max.) projects can you handle simultaneously?

This survey results aim to confirm the effectiveness, improvement, innovation, and optimized way of dealing with the projects and the team. Some project manager (PM) prefers more conventional project team structures. This study confirms that the result in **Table 4**, **Figure 12**, and **Figure 13** is randomly based on the PM's opinion from survey data. In this regard, for up to 3 projects, the performance can be quantified and controlled. Moreover, beyond three projects may not be an excellent and unreasonable quality of product deliverables.

Table 5 and **Figure 8** perspective, and the actual results of these surveys as shown in **Table 4**, **Figure 12**, and **Figure 13**. It might be the possible outcome for most teams, loads, and monetary effects without compromising product quality. The more person-hour consumption, the more incentive can get.

By principle, the higher the workload, the lower the performance. If the value is higher, there will be a tendency for the low efficiency of product quality, and the performance will decline due to overload. In **Figure 8**, by applying the MSS concept, load proportion to the incentive, to convey and boost the performance of each team, compare hiring or outsourcing personnel with additional labor responsibilities. Since the project is not permanent, better utilize and motivate each technical staff to maintain its competitiveness and effectiveness while finding alternative resources. As a project manager and, at the same time, corporate officer, the organizational set-up should be strengthened.

Table 3. PM capacity matrix (Sample: LNG receiving terminal).

Project Manager (PM)	Capacity, MT								
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
PM - P8a$_1$									
PM - P8a$_2$									
PM - P8a$_3$									
PM - P8a$_4$									
PM - P8a$_5$									
PM - P8a$_6$									
PM - P8a$_7$									
PM - P8a$_8$									
PM - P8a$_9$									

■ Typical capacity per project manager (PM) for effective project management; ■ Max. of three projects of each PM for effective project management; Notes: [1]PM in P-8a may not be the same person performing or handling the projects. Moreover, the estimated effectiveness of project management for PM can handle up to a max. of three projects; [2]n (1, 2, 3, ···, i); incremental of 1x = 1MT, 1MMTPA (refer to **Figure 9**, **Figure 11**) $x_1 \cdots n$, No. of projects allocated in specific PM. Basis, 3MMTPA = 1B US$ (Typical Project Budget) Metric Ton (MT); Million Metric Ton per Annum (MMTPA)

Table 4. SQ summary result, respondent's opinion.

Item	Project Description	Sample Population[1]	No. of Projects				
			5	4	3	2	1
P-1	Oil & Gas (Upstream, Rig Platform)	10	0	0	1	1	8
P-2	Oil & Gas Treatment Plant	15	0	0	0	2	13
P-3	Wastewater Plant	5	0	0	1	1	3
P-4	Power Plant	20	0	0	1	7	12
P-5	Petro Refining Plant	18	0	0	0	1	17
P-6	Petro Chemical Plant	12	0	0	1	1	10
P-7a	LNG Processing Plant	15	0	0	1	11	3
P-7b	LPG Processing Plant	16	0	0	2	13	1
P-8a	LNG Receiving & Regasification Plant	17	0	0	7	9	1
P-8b	LPGReceiving & Regasification Plant	25	0	0	5	21	1
Total		153	0	0	19	65	69

Notes: [1]The respondence has at least five (5) years in the project as a PM.

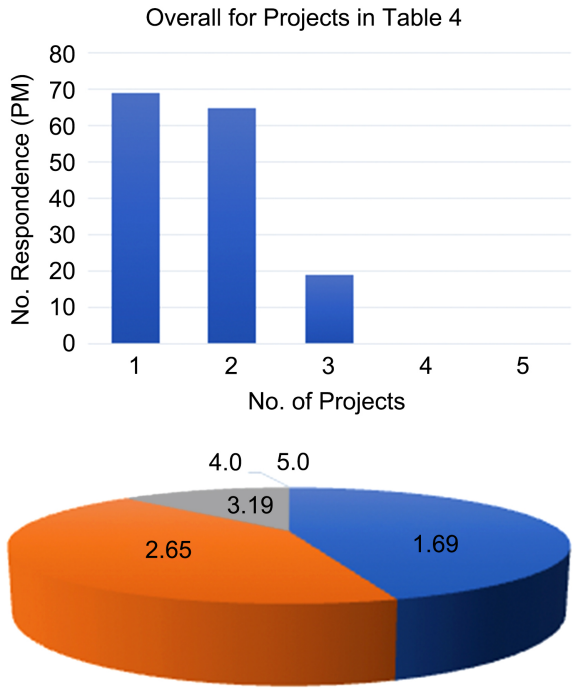


Figure 12. SQ overall summary result.

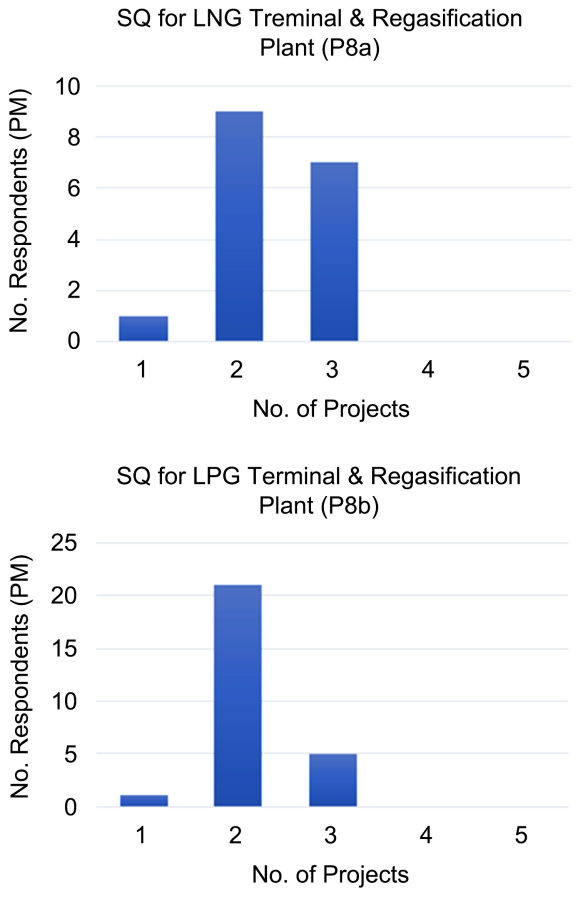


Figure 13. SQ overall summary result, P8a/b.

Table 5. Estimated result of LCD[1].

LCD	Conv.	Survey	Case 1.1	Case 1.2	Case 1.3
Low	0.13	0.22	1.12		
Medium				1.32	
High					1.53

[1]Mean value only.

8. Conclusion

The multi-structure and scale (MSS) in project execution management (PEM) focuses on project manager (PM) and project functional specialist capabilities, the depth of their expertise, and experiences in the field. In a conventional setup, one (1) PM is assigned for each project (including other project team members). In this recommendation, it might be up to two (2), and a maximum of three (3) is possible. Furthermore, more than three (3) projects are not good and might be an ineffective way of handling the project.

The relationship between loads and incentives in **Table 2** and **Figure 8** might be another option while finding additional project team members for a particular project. With the implementation and collaboration of software for the VPM environment, this multi-tasking and scale (MSS) concept can be possible without any hesitation and with a range of effectiveness.

This MSS Concept is based on researchers' observations, experiences, and the best ability for operational usage and practicality in better application and implementation.

Furthermore, this study, it's required for a better understanding of this research, application, and implementation of using the MSS Concept.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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