

## Production Equipment Project Management – A Conceptual Framework with Multiple Mediators

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**Abstract:** Production equipment project management (PEPM) in the manufacturing industries has been emerged as one of the important management elements from cost, time and quality perspective. PEPM made up of two main components, namely soft PEPM and hard PEPM. The soft project management aspect refers to the key PEPM management success elements such as strategy, innovation and financial management, while hard PEPM denotes to PEPM tools and technique. Project Management is commonly defined as a temporary endeavour undertaken to create a one-time unique product or service. As such, most of the literatures on both hard and soft project management are confined within the border of this definition. However, the nature of PEPM is beyond the scope of the common project definition, where PEPM could be a long term management process that creating both unique and repeated products. Hence, this paper aims to close the literature gap by proposing a PEPM performance conceptual framework that integrated the hard project management projects tools and technique as multiple mediators between soft project management and PEPM performance.

**Key words:** Production Equipment • Project Management • Hard Tool • Soft Tool

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### INTRODUCTION

Management of production equipment such as assembly jig, fixture and tester has increasingly viewed as important management stream toward organizational performance [1]. Management of production equipment is characterized by the non-highly repetitive and non-routine attributes; hence it is beyond the scope of production or process management discipline which is highly repetitive and routine. As such, production equipment management is categorized under the “project management” stream instead of process management. Project Management is commonly defined as *a temporary endeavor undertaken to create a one time unique product or service* [2, 3].

As such, most of the literatures on management are confined within the border of this definition. However, the nature of production equipment project management or PEPM is beyond the scope of the common project definition, where PEPM could be a long term management process that creating both unique and repeated products.

Figure 1.0 shown the 4 common process strategies (i.e. Process Focus; Repetitive; Product Focus and Mass Customization) positioned based on the variety of process and volume of output. PEPM is found not belong to any of the strategy due to the complex nature of PEPM. Hence, this paper aims to close the literature gap by proposing PEPM should be positioned at the integration area of Process Focus, Repetitive and Mass Customization strategy as shown in Figure 1.0.

### Production Equipment Project Management (PEPM)

**Performance:** Manufacturing and assemblies industries are blooming and the competition have driven the upgrading of process efficiency to sustain competitive advantage [4]. As such, production equipment used in manufacturing and assembly industries become more complex in term of design and requirement. Hence, management of production equipment or Production Equipment Project Management (PEPM) becomes one of main challenge for manufacturing and assemblies industries to stay competitive.

# Process, Volume, and Variety

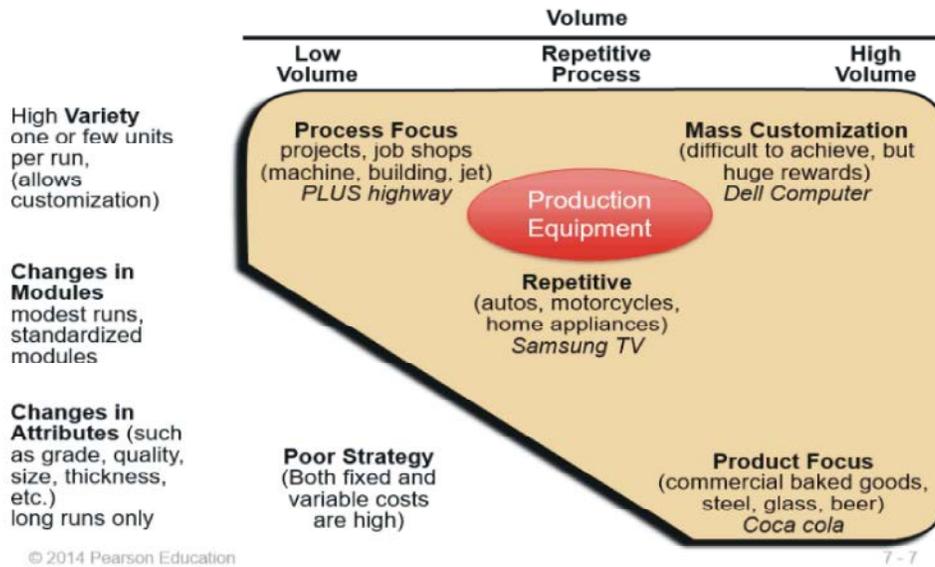


Fig. 1.0 [2, 3]: Production Equipment in Process , Volume and Variety Comparisons

The objectives of production equipment project management or PEPM are to ensure production equipment is design and fabricated according to the production needs (i.e. meet quality requirement), within the cost limit and delivered on time. As such, the typical PEPM performance measures used are refer to “on cost, on time and on quality”.

PEPM made up of two main components, namely soft PEPM and hard PEPM. The soft project management aspect refers to the key PEPM management elements such as strategy, innovation and financial management, while hard PEPM denotes to PEPM tools and technique (T & T).

**Soft Project Management Elements:** Soft project management elements are associated with the methodological intangible management elements or approach that applied in project management, such as information management, financial management planning and customer management.

Management on the soft aspect of PEPM is dependent and driven by the organization philosophy, culture, policy, mission and vision; which are vary from one organization to the other, as such there is no standard and tangible methodology dealing with how such soft PEPM elements should be managed. The soft PEPM elements are defined as project management success factors in some for prior study. The common sets of soft

PEPM elements suggested by prior researcher are summarized in Table 1.0 which consist of Investment Management, Strategy Management, Information Technology Management, Manufacturing Technology Management, Innovation Management, Procurement/Financial Management and Customer Management.

**Hard Project Management Elements:** Hard PEPM refers to the tangible methodology and approach used in project management. The hard element of PEPM is commonly named as Project Management Tools and Techniques by prior researchers. PEPM tools and techniques or hard PEPM such as Critical Path Method (CPM), Project S-curve, Project Failure Mode and Effect Analysis are suggested by the prior researcher as the important elements in project management [11]. There are few approaches in the categorization of the project management tools and techniques. [12, 13, 14]. The common categorization are based on the projects stages or phases. The cycle of PEPM is commonly made of five phases, which are Project initiating, Project planning, Project execution, Project monitoring & control and Project Closing. Different sets of tools and techniques are requires for each phase to facilitate the progress of activities and delivery of objectives. Table 2.0 summarized the hard PEPM category basses on the project cycle or project phase.

Table 1.0: Soft Project Management Elements (Success Factors)

	Don Hee Lee <i>et al.</i> [5]	Miao Jian, <i>et al.</i> [6]	Liangwen Liu, Jianxiang Ye [7]	Ying-Ju Chen, Yutian Chen [8]	Satish Tyagi <i>et al.</i> [9]	Firoozi, M. <i>et al.</i> [10]
Soft Project Management						
Investment Management	✓					✓
Strategy Management	✓		✓	✓	✓	
Information Technology Management		✓				
Manufacturing Technology Management	✓	✓	✓			
Innovation Management		✓	✓			
Procurement / Financial Management				✓		✓
Customer Management					✓	✓

Table 2.0: Hard PEPM categorize base on the project phases

Reference	International Project Management Association, IPMA [12]	Project Management Institute, Inc.PMI [13]	Harvey Maylor, 4D model [14]
Project Phase	Initiation and start-up T & T Plan and control T & T	Project initiating T & T Project planning T & T	Define it - Stakeholders, strategy and success, Initial planning Design it - Time planning, Rethinking time planning: the critical chain approach, Cost and benefit planning, Stakeholders and quality, Risk and opportunities management
	Close-out T & T	Project execution T & T  Project monitoring and control T & T Project Closing T & T	Do it - Project organisation: structures and teams, Management and leadership in projects, Control, Supply chain issues, Problem-solving and decision-making Develop it - Project completion and review, Improving project performance

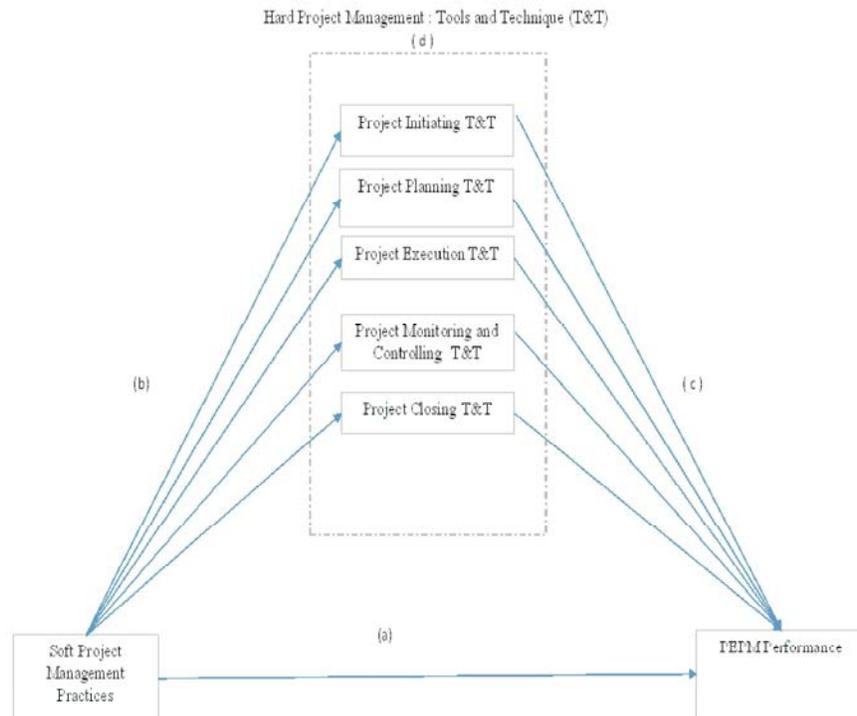


Fig. 2.0: Multiple Mediators PEPM Performance Framework

**PEPM Conceptual Framework:** The management of product equipment is complication in nature [15] as it is unlike the general project management which is one-off and unique; and it is also different from production

process which is characterized by the nature of high volume and less variety. As such this paper aims to propose a conceptual framework to deal with the complication of PEPM.

The conceptual framework for PEPM is developed base on System Theory [16]. System theory focuses on interdisciplinary study with the objective to elucidating principles that can be applied to all levels of the system, or in this study refer across all phases of to PEPM.

System theory emphasizes on three system elements, the input of the system, the throughput (processing) and the output. Within the scope of this paper, soft PEPM or the success factors for PEPM is defined as input for the system, PEPM performance as the output, hard PEPM or PEPM tools and technique as the processing mechanize of the system. In conjunction with this, a multiple mediators PEPM conceptual framework is proposed as shown in Figure 2.0.

### **DISCUSSION**

The uniqueness of the proposed framework is the framework assess the mediating effect of each category of hard PEPM aspects toward PEPM performance; with the objective to identify which processing mechanize (or hard PEPM) mediate the relationship between the input (soft PEPM) and output (PEPM performance).

In accordance to the review, there are significant amount of the studies conducted by the prior researchers in connection to the success factors for soft project management practices [17, 18]. However, there have been limited research look into the area that does hard project management elements moderate the relationship within soft PEPM and PEPM Performance. Hard project management elements have been acknowledged by the prior researchers for play the utmost important impact to the performance for example in the area of quality management.

Study by Adam [19] supported that the quality tools and techniques is positively correlated to operational performance. For the financial area, Bunny & Dale [20] concluded that the relationship is positive between quality tools and techniques and the financial performance. Tari & Sebater [21] have then further supported this where the quality tool and techniques have concluded the positive impact to the organizational quality performance.

As such, this paper argues that the relationship between soft PEPM and performance is moderated by hard PEPM. In conjunction with this, the framework proposed in this paper close the theoretical gap by investigating the mediating effect of each hard management elements toward the relationship between Soft PEPM and PEPM performance.

### **CONCLUSION**

Inline with the increasingly important in PEPM and to fill the gap of this area, with the proposed framework the continuation of this paper is therefore recommended to test on the relevance and the validity of the proposed framework with the ultimate aim to develop a universal PEPM Performance framework.

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