

PROJECT QUALITY MANAGEMENT PRACTICE AND THEORY

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ABSTRACT

Little research existed in the field of project management (PM) prior to government and corporate implementation. Praxis existed long before PM became an academic discipline or theory. The focus of this research is on theory development within academia, that supports or refutes the PMBOK, with an emphasis upon Project Quality Management (PQM) knowledge area to identify gaps in theory, and simply stated: *Has PM theory caught up with praxis?*

INTRODUCTION

Project management is the planning, organizing, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives. This definition is like that of management, however it is focused upon short-term objectives. So, this paper is focused upon management theory as it applies to project management as a sub-discipline, and more specifically the overlap between project management and quality management theory. Understanding how the generic discipline of management evolved strengthens one's knowledge base [40], however as reported by Schley and Lewis [39] project management as a discipline lacked comprehensive theoretical grounding.

Why is theory development for project management important? Theory building helps explain the PM phenomenon, and ultimately has practical application in the business world [11]. Initially, there was a dearth of literature in academia related to project management, therefore practitioners, not academics, created the PM theoretical framework via first-hand observations. The baseline attempt at a Project Management Body of Knowledge (PMBOK) included six management disciplines: scope, time, cost, communications, human resources, and quality. At inception, the PMBOK included Project Quality Management (PQM) as one of the key knowledge areas, including three major project documents: the project charter, the project scope statement and the project management plan. The project management plan includes a quality management plan which incorporates three foci: quality planning, quality assurance and quality control. So, through the adoption of PQM, the project management discipline falls within the optimization school of thought [9] [14].

LITERATURE REVIEW AND HYPOTHESIS

Project management was practiced during the planning and execution of the D-Day invasion of Europe, the Manhattan Project that created nuclear bombs, the building the Atlas and Polaris missile systems, and the Apollo moon mission [19] [28]. However, most of these projects did not formally apply the tools, techniques, or arguably language or concepts of the project management discipline until after the mid-1950s [34]. Around 1953–1954 McDonnell Aircraft formally created the project manager position; nearly simultaneously, Martin (Marietta) established the first matrix organization [6] [27] [34]. None-the-less, the United States Air Force (USAF) had the first recognizable project management practitioners in modern history with Brigadier General Bernard Schriever serving as the project manager for the Atlas Inter-Continental Ballistic Missile (ICBM) in 1955. Just a year later, Vice Admiral William Raborn became the program manager for the Polaris ICBM [34] [38]. Project management as an academic

discipline was not yet fully developed, but international tensions due to the cold war led to implementation of nascent project management principles.

In 1917, Henry Gantt created a planning and tracking tool chart, which was a stepping stone toward the development of two new tools: Planning and Evaluation Review Technique (PERT) and the Critical Path Method (CPM). Admiral Raborn popularized PERT during his briefings to Congress, and others followed suit. In addition to tools, the USAF created project management offices (PO/PMO) during the 1950s. McDonnell Aircraft created a civilian version of a project manager position; and Martin Marietta developed the matrix organization to tackle highly technical systems. In addition, work breakdown structure (WBS) and earned value analysis (EVA) gained use during the 1960s [34] [39].

Paul Gaddis [19] was the first to publish an article addressing the roles of the project manager (PM). He identified that the PM's basic responsibilities are to "deliver his end-product (1) in accordance with performance requirements, (2) within the limitations of his budget, and (3) within the time schedule that his company or customer has specified" [19, p. 91]. Hence, he emphasized cost, time and quality, which are enduring legacies today. He identified that the project manager must be an expert communicator who can discuss budgets with upper management, and technology issues with engineers and scientists, so the PM must be schooled in multiple disciplines. Gaddis made a significant stride in identifying what a project manager does, or should do, but his article did not rise to the level of theory.

Project Management Institute

Founded in 1969, the Project Management Institute (PMI) undertook the responsibility to capture the body of knowledge and develop a certification system for current and future project managers. In 1981, the PMI Board of Directors initiated a project with three foci: ethics, standards, and accreditation. PMI published a draft Project Management Body of Knowledge (PMBOK) in 1983 that included six major knowledge areas: scope, cost, time, quality, human resources and communications management. In 1987, a revised PMBOK added two knowledge areas: risk management and contract/procurement management. Of significance to this paper, quality management has been part of the PMBOK since inception [37].

Morris [34] reports that when reliability problems occurred during Atlas tests in 1956-57, a lack of documentation made it difficult to find problem causation. In addition, set-backs during the 1960s and 1970s such as the U.S. Super Sonic Transport and the Trans-Alaskan pipeline caused practitioners to relook the elements of cost, time, quantity, and quality as well as environmental impacts. Most significantly, the malfunction of the Three Mile Island nuclear reactor refocused project management practitioners upon quality management [34]. Therefore, it is not surprising that during the development of the PMBOK, quality management was adopted as a knowledge area.

Although the original goal of the PMBOK was to outline knowledge not available in other fields, the PMBOK borrowed from Total Quality Management (TQM) for the PQM knowledge area. TQM and PM are complementary as both focus upon optimization. Historically, Frederick Taylor focused on scientifically increasing quantity; TQM focused on statistically enhancing quality outcomes; and now PM strives for cost and time efficiency by defining the objective(s) of the project; breaking the project into smaller components; ensuring careful planning, scheduling, estimating, and execution of project tasks for an optimal outcome [9][24].

The PM Body of Knowledge as Precursor to Theory

The Project Quality Management Knowledge Area includes three quality processes: quality planning, quality assurance, and quality control. The PMBOK Guide provides the following definitions:

- Quality Planning involves identifying which quality standards are relevant to the project and determining how to satisfy them.
- Quality Assurance is all the planned and systematic activities implemented within the quality system to provide confidence that the project will satisfy the relevant quality standards.
- Quality Control involves monitoring specific project results to determine if they comply with relevant quality standards, and identifying ways to eliminate causes of unsatisfactory performance.

The PMBOK inputs and outputs of PQM appear to be most closely associated to Joseph Juran's three steps to quality using 'Big Q' and little 'q' to contrast the difference in foci: 'Big-Q' is managing for quality in all business processes and products and little-q is managing for quality in a limited capacity such as factory products and processes. Due to the temporary nature of projects, project management is naturally focused upon Little-q more than Big-Q in the development of Critical Success Factors (CSF) [24]. The CSF logic flow led to the aim of this study, which was to review the empirical literature that has been written about project quality management (PQM), to determine whether it supports, rejects, or modifies the PMBOK PQM criteria, constructs, and model. Specifically, the study is geared to answer the following two research questions (RQ):

RQ1: Is PQM theory sufficiently developed?

RQ2: Have the relationships among the PQM constructs been empirically tested, or do they need further research?

DATA ANALYSIS AND RESULTS

The focus of this research is on theory development within academia, that supports or refutes the PMBOK, with an emphasis upon PQM. However, the PMBOK has been identified as a system of systems, therefore it is difficult to segment quality management from the remaining functional areas. As such, the study uses a "grounded theory" approach. Grounded theorists, in contrast to purely quantitative researchers, begin data collection without a specific theory or model. Instead of moving from a hypothesis to results, the grounded theorist moves from empirical data and ends at the conceptual level, generating theory or models that can be operationalized for future testing. In this meta-analysis, the empirical data comes from qualitative data collection and analysis of the quantitative studies pertaining to PM Critical Success Factors (CSF), and follows a grounded theory approach [20].

Grounded theory, as formulated by Glaser and Strauss [20] grounding and/or 'generating' elements must be obtained through a meticulous comparative analysis of the collected data, which is why grounded theory is also referred to as a "constant comparative method" [13] [20]. "Joint collection, coding and analysis of data are the underlying operations" [13, p. 5]; all three should blur together, continuously intertwining, while simultaneously influencing each other, "from the beginning of an investigation to its end" [20, p. 43]. Hence, this investigation was not as lockstep or methodologically simple as many quantitative studies, because grounded theory approach to synthesis and analysis "seeks to tease out and define underlying relationships through an inductive and intuitive interpretation of the data" [2, p. 177].

Project Management Critical Success Factors (CSF)

Fortune and White [18] conducted a comprehensive investigation of CSF related to project management. Their review of 63 publications resulted in the list shown in column three. When cross-walking these PM critical success factors with the PM functional areas, there were several CSF that did not neatly align. Therefore, the next step was to compare project management CSF from a quality perspective. Using Malcolm Baldrige National Quality Award criteria, the PM CSF aligned as per column one above. Seven of the CSF align with the MBNQA category of leadership as shown.

MBNQA Categories	PMBOK Functional Areas	Critical Success Factors (CSF)
Strategy (Planning)	Integration	Strong Business Case/sound basis for project Strong/Detailed Plan kept up to date Effective Change Management Planned Close Down/Review
	Scope	Clear Realistic Objectives
	Time	Realistic Schedule
	Cost	Adequate budget
	Risk	Risks addressed/assessed/managed
Measurement, Analysis, and Knowledge Management	Quality	Correct choice/past experience of project management method/tools Proven/familiar technology Effective Monitoring/control
Workforce	Human Resources	Competent Project Manager Skilled/suitably qualified/sufficient staff/team Training Provision Past experience (learning from)
Customers & KM	Communicate	Good Communication/feedback User/client involvement Different viewpoints appreciated
Operations	Procurement	Good performance by suppliers/contractors/consultants
CSF that are not represented within the PMBOK Functional Areas:		
MBNQA Categories	PMBOK Functional Areas	Critical Success Factors (CSF)
Leadership		Support from Senior Management Project Sponsor/Champion Good Leadership Sufficient/well allocated resources Organizational adaptation/ culture/structure Learning from past experience Project size/level of complexity/number of people/duration

Figure 1: MBNQA, PM and CSF Crosswalk

An additional thirty peer-reviewed, empirical studies within the project management knowledge areas substantiated research foci upon time and cost, but indicated a need to expand research focus upon quality planning, quality assurance and quality control. Details on each study reviewed are not provided due to space limitations, however a few of the most pertinent studies are described below.

- Zwikael et al [53] ranked 16 planning processes according to their impact on project success and actual extent of use. They found that the quality planning process that has impact upon all measures of project success, has a very low usage by project managers. They determined that project managers do not use PQM often enough, despite its importance, thusly supporting Sun et al [44] who found PQM in new product development was of high importance, but of low implementation.
- Cao and Swierczek [12] assessed how managers in infrastructure projects in Vietnam perceived project success and its related factors. From a theoretical perspective, the results of their factor analysis also provide some confirmation of the success factors, including cost, time, technical performance and customer satisfaction. Their technical performance factor is interpreted as inclusive of quality standards, but was not *specifically* PQM focused.
- Besteiro, et al [7] identified these variables as being the most important ones to be managed: project communication, defining the schedule, accepting the project mission, team qualification, indicating roles and responsibilities, realistic goals and objectives, commitment from the board of directors, and determining the financial boundary. Yet, there was no mention of PQM in this study.
- Zakari, et al [52] grouped and then ranked a total of 58 factors that could affect project success in the Space Industry and found that the most important success factor in projects is the Project Team Competence. Surprisingly, despite the quality issues related to the Space Shuttle Challenger disaster, there was not a specific mention of PQM, although it could be loosely implied from Project Team Competence.

This detailed literature review answered the following two research questions (RQ):

- RQ1: Is PQM theory sufficiently developed? Answer: *Not yet.*
- RQ2: Have the relationships among the PQM constructs been empirically tested, or do they need further research? Answer: *Further research in projects, with a focus on quality is needed as well as the inter-relationships among disparate parts.*

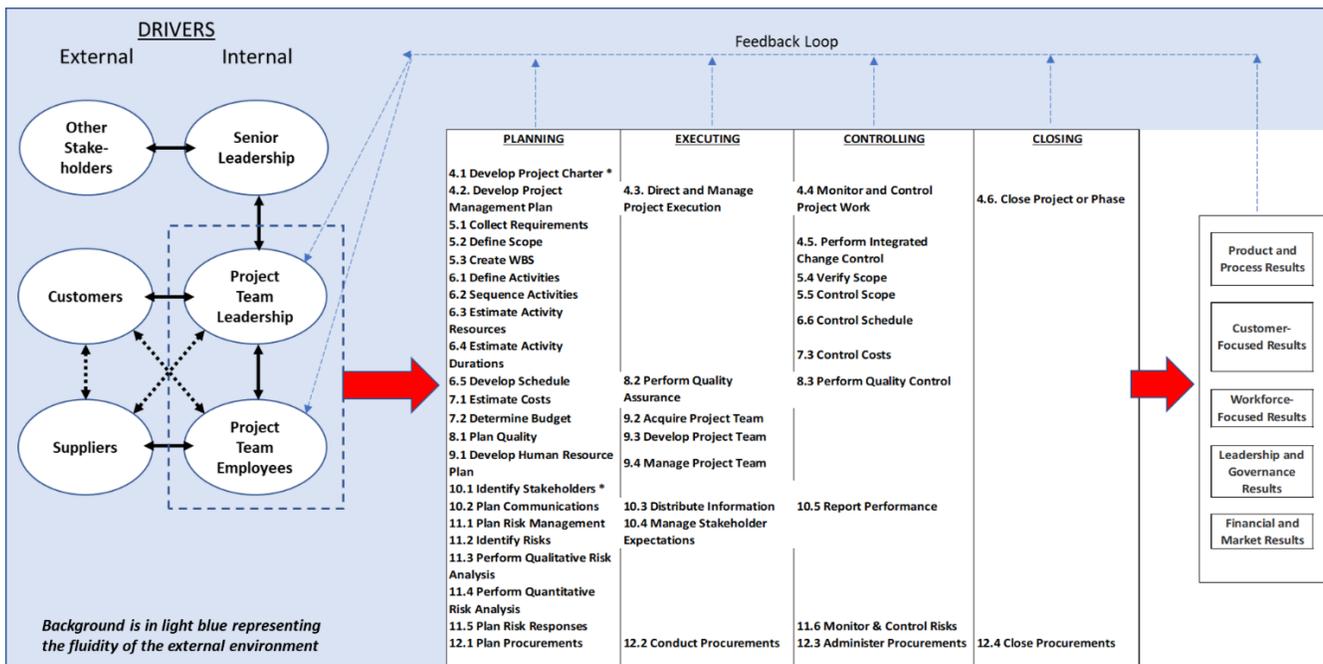


Figure 2: Meta-Model of Project Quality

DISCUSSION AND CONCLUSIONS

Substantial research has been conducted since the creation of the PMBOK, toward identifying Critical Success Factors (CSF) that contribute toward, but do not yet unify, a global theory of project management. The PQM model in Figure 2 represents a modification of Baker's [1, p. 239] Meta Model for Total Quality Management.

Using grounded theory's constant comparative method, the author used joint collection, coding and analysis of data as the underlying method. MBNQA criteria, PM functional areas (processes) and CSF all come together, continuously intertwining, while simultaneously influencing each other. The model begins with the customer who influences both senior leadership as well as the Project Team Leader. The senior management may have inputs from both customers as well as external stakeholders. And the two-headed arrows represent communications among customers, suppliers, and the project leader and team. The dashed box indicates the boundary of the project leader and team which serve as drivers for the functional areas outlined by the PMBOK. [Note: The author included "identifying stakeholders" and "developing the project charter" in the Planning Phase, rather than a separate initiating phase]. In addition, the PMBOK does not fully address "results" therefore MBNQA five results were added to the model: (1) Product and Process, (2) Customer-Focused, (3) Workforce-Focused, (4) Leadership and Governance and (5) Financial and Market Results. Lastly, a feedback loop was added in dashed lines indicating the impact of external forces upon feedback and communication. Finally, the model also includes a blue background indicating the fluid nature of the environmental impact. This model cross-correlates data from MBNQA, PMBOK and CSF; research needs to focus on the interaction of all parts.

Jugdev et al [23] identified that an American emphasis on peer reviewed journals may have impeded publication of scholarly articles focused upon success factors, success criteria, and success frameworks, which had been widely published a decade prior in Europe. Hence, future research should strive to compare, contrast and integrate the project management theory among American, Asian, and European constructs. If all PQM researchers could agree upon the same CSF, then future research could focus upon longitudinal studies that could be replicated throughout different countries and industries.

This study finds that project management theory development overwhelmingly supports the PMBOK emphasis upon scope, time and cost management. However, only 20% of the articles reviewed by Fortune and White [18] and one-third of the subsequent empirical articles in this review specifically addressed PQM; unfortunately, several of the recent studies failed to mention PQM at all. Hence, future research should continue to investigate the symbiotic relationship between project management success or failures related to project quality management implementation.

Most importantly, this study finds that leadership should be added as a driver within the PMBOK framework. Baker [1] identified that leadership is the primary driver of all quality management processes; Fortune and White [18] identified seven CSF that are leadership driven. Senior leadership, the management style of senior leaders as well as the project manager; and empowerment for decision making to the lower levels were considered critical in most of the empirical studies [1] [3] [16] [21] [22] [25] [31] [36] [41] [43] [44] [46] [47] [49] [50] [51]. Therefore, this holistic project quality management model is proposed to assist in visualization as well as future research studies.

REFERENCES

Due to page limitations, references are not included, but are available upon request.