Project Quality Management Practice & Theory

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Little research existed in the field of project management (PM) prior to government and corporate implementation. Practice 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 (Söderlund et.al., 2013), however as reported by Schley and Lewis (2017) 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 (Byron, 2016). 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. Of significance, the PMBOK included Project Quality Management (PQM) as one of the key knowledge areas at inception, 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 [Bredillet, 2007; Cleland, 1983].

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 [Gaddis, 1959; Lenfle, 2011]. 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 (Morris, 2013). Around 1953–1954 McDonnell Aircraft formally created the project manager position; nearly simultaneously, Martin (Marietta) established the first matrix organization [Bergen, 1954; Lanier, 1956; Morris, 2013]. 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. And just a year later, Vice Admiral William Raborn became the program manager for the Polaris ICBM [Morris, 2013; Sapolsky, 1972]. Project management as an academic discipline or theory was not yet fully developed, but international tensions due to the cold war led to implementation of nascent project management principles that evolved from earlier decades.

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 expanded use of these tools, the USAF created project officers and 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, newly developed work breakdown structure (WBS) and earned value analysis (EVA) gained use during the 1960s [Morris, 2013; Schley, 2017].

Paul Gaddis (1959) was the first to publish an article addressing the roles of a 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" (Gaddis, 1959, p. 91). Hence, Gaddis 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, yet his article did not fully 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 study project with three foci: ethics, standards, and accreditation. PMI published a draft Project Management Body of Knowledge (PMBOK) in 1983 that included: scope, cost, time, quality, human resources and communications management. In 1987, a revised PMBOK added two more knowledge areas: risk management and contract/procurement management. Of significance to this paper, quality management has been part of the PMBOK since inception (PMI, 2004).

Morris (2013) 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 (Morris, 2013). 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 heavily from Total Quality Management (TQM) for the PQM knowledge area. TQM and PM are complementary since 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 [Bredillet (2007); Juran, et.al., 1999].

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 of the 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) (Juran et.al., 1999). 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, this study is focused upon the following two research questions (RQ):

- RQ1: Is Project Quality Management (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, this study uses a "grounded theory" approach. In contrast to purely quantitative researchers, grounded theorists 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 using a grounded theory approach (Glaser, et.al., 1967).

Grounded theory, as formulated by Glaser (1967), 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 [Chicchi, 2000; Glaser, 1967]. "Joint collection, coding and analysis of data are the underlying operations" (Chicchi, 2000, p.5); all three should blur together, continuously intertwining, while simultaneously influencing each other, "from the beginning of an investigation to its end" (Glaser, 1967, p.43). Hence, this investigation was not as methodologically straight-forward 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" (Baker, 2002, p.177).

Project Management Critical Success Factors (CSF)

Fortune and White (2006) 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 (MBNQA) criteria, the PM CSF aligned as per column one. Seven of the CSF align with the MBNQA category of leadership as shown.

FIGURE 1
MBNQA, PM AND CSF CROSSWALK

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 Resourses	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

An additional thirty peer-reviewed, empirical studies within the project management knowledge areas substantiated research foci upon scope, 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. (2006) 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, but it actually has a very low usage by project managers. They determined that project managers do not use PQM often enough, despite its' importance, thereby supporting Sun et.al. (2005) who found PQM in new product development was of very high importance, but of low implementation.
- Cao et.al. (2010) 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,

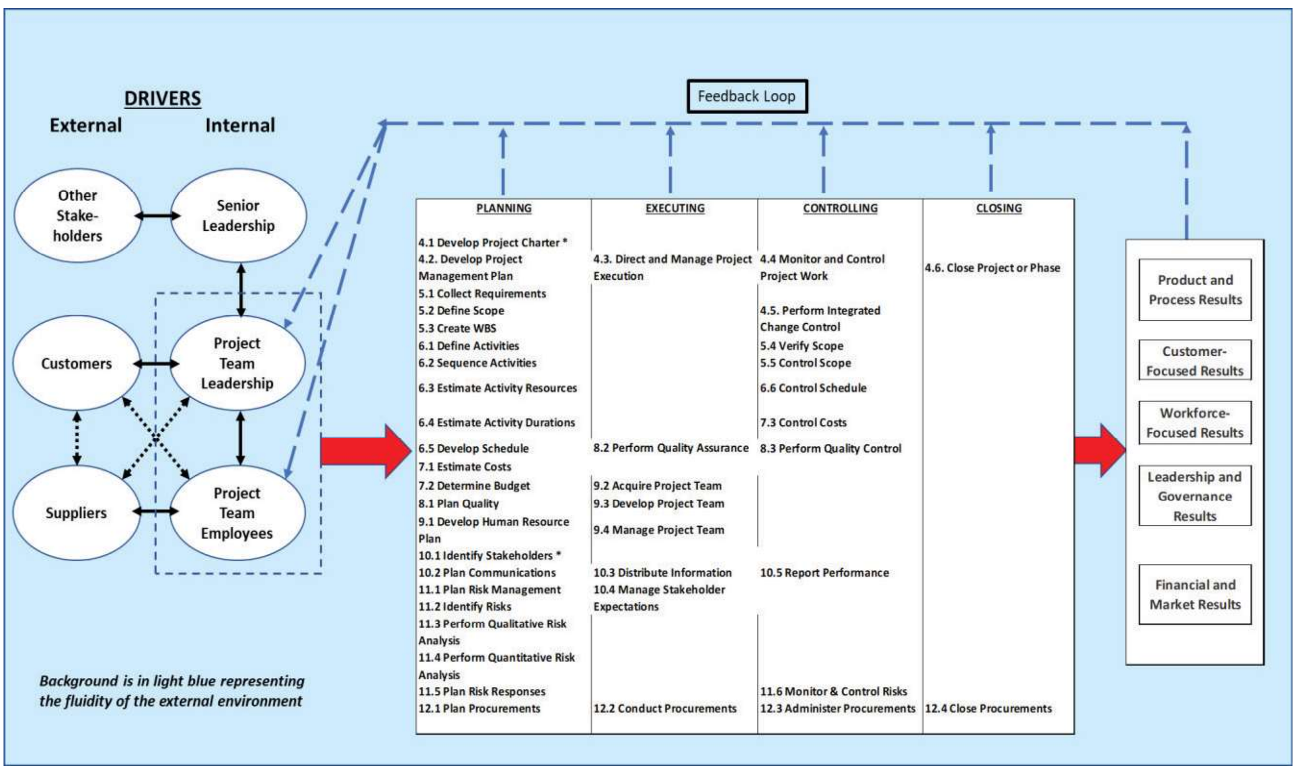
technical performance and customer satisfaction. Their technical performance factor is interpreted as inclusive of quality standards, but was not *specifically* PQM focused.

- Besteiro, et.al. (2015) 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 that study.
- Zakari, et.al. (2016) 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's 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 very 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 (2004, 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. Also, a feedback loop was added in dashed lines indicating the impact of external forces upon feedback and communication. Finally, the model includes a shaded 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. (2005) 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 research 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 (2006) and just 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 (2004) identified that leadership is the primary driver of all quality management processes; and Fortune and White 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 [Baker, 2004; Baker et.al., 1986; Cooper et.al., 2007; Holland, 1999; Jaselskis, 1988; Kappelman, 2006; Might, 1985; Pinto, 1989; Somers, 2004; Sumner, 1999; Sun, 2005; The Standish Group, 1994; Tishler, 1996; Whittaker, 1999; Yeo, 2000; Yu, 2010]. In conclusion, this holistic project quality management model is proposed to assist in future studies.

REFERENCES

Baker, B. (2004). *TQM Practice and Theory: A Meta-Analysis of Empirical Studies.* Dissertation Abstracts International, Vol. 65 Issue 1A, page 206. Publisher is Proquest Information & Learning (formerly UMI), Ann Arbor Michigan 48106. Publication #3117237.

Baker, M. J. (2002). *Research methods*. *The Marketing Review,* 3(1), 167-193.

Baker, N. R., Green, S. G., & Bean, A. S. (1986). *Why R&D Projects Succeed or Fail*, *Research Management,* 29, November– December, 29– 34.

Baker, B., Murphy, D. C., & Fisher, D. (1983), *Factors affecting project success*, In: Cleland, D. I. and King, W. R. (eds.) *Project Management Handbook*, Van Nostrand Reinhold: New York.

Balachandra, R., & Raelin, J. A. (1984). *When to Kill that R&D Project*, *Research Management*, 4, July–August, 30– 33.

Bergen, W. B. (1954). *New Management Approach at Martin* (Marietta). *Aviation Age*, 20(6), 39-47.

Besteiro, É., Carpim, N., de Souza-Pinto, J., & Novaski, O. (2015). Success Factors in Project Management. *Business Management Dynamics*, 4(9), 19-34.
Bignell, V., & Fortune, J. (1984). *Understanding Systems Failures*, Open University Press/Manchester University Press: Manchester.
Bredillet, C. N. (2007). Exploring Research in Project Management: Nine Schools of Project Management Research (Part 3). *Project Management Journal*, 38(4), 2-4.
Busi, F., Barry, M.-L., & Chan, A. (2011). Critical Success Factors for instrumentation and control engineering projects in the South African petrochemical industry, Technology Management in the Energy Smart World (PICMET). *2011 Proceedings of PICMET '11*, Portland, OR, 1– 8.
Byron, K., & Thatcher, S. B. (2016). Editor's Comments: What I know now that I wish I knew then – Teaching Theory and Theory Building. *Academy of Management Review*, 41(1), 1-8.
Cao Hao, T., & Swierczek, F. W. (2010). Critical success factors in project management: implication from Vietnam. *Asia Pacific Business Review*, 16(4), 567-589.
Chicchi, F. (2000). Grounded theory and the biographical approach: An integrated heuristic strategy. *International Review of Sociology*, 10(1), 1-19.
Cleland, D. I., & King, W.R. (1983). *Systems analysis and project management* (3rd ed.). New York: McGraw-Hill.
Cooke-Davies, T. (2002), The "real" Success Factors on projects. *International Journal of Project Management*, 20(3), 185– 190.
Cooper, R. G., & Kleinschmidt, E. J. (2007). Winning businesses in product development: The Critical Success Factors. *Research-Technology Management*, 50(3), 52– 66.
Flyvbjerg, B., Bruzelius, N., & Rothengatter, W. (2003). *Megaprojects and risk: An anatomy of ambition*. Cambridge University Press: Cambridge.
Fortune, J., & White, D. (2006). Framing of project critical success factors by a systems model. *International Journal of Project Management*, 24(1), 53-65.
Gaddis, P. O. (1959). The Project Manager. *Harvard Business Review*, 05/1959
Glaser, B. G., & Strauss, A. L. (1967). *The Discovery of Grounded Theory: strategies for qualitative research*. Chicago: Aldine.
Holland, C. P., & Light, B. (1999). A Critical Success Factors model for ERP implementation. *IEEE Software*, 16(3), 30– 36.
Jaselskis, E., & Ashley, D. B. (1988). Achieving construction project success through predictive discrete choice models. *Proceedings of the 9th World Congress Project Management*, Association of Project Managers, September 4– 9, 1988, Glasgow, Scotland, 71– 85.
Jugdev, K., & MÜller, R. (2005). A Retrospective Look at Our Evolving Understanding of Project Success. *Project Management Journal,* 36(4), 19-31.
Juran, J. M., & Godfrey, A. B. (1999). *Juran's Quality Control Handbook*. (5th Ed.). New York: McGraw Hill Book Co.
Kappelman, L., McKeeman, R., & Zhang, L. (2006). Early warning signs of it project failure: The dominant dozen. *Information Systems Management*, 23(4),31– 36.
Kerzner, H. (2003). *Project Management: A Systems Approach to Planning, Scheduling & Controlling*. Berea, Ohio: John Wiley & Sons, Inc.
Lanier, F. (1956). Organizing for Large Engineering Projects. *Machine Design*, 27, p.54.
Lenfle, S. (2011) The Strategy of Parallel Approaches in Projects with Unforseeable Uncertainty: the Manhattan Case in Retrospect. *International Journal of Project Management*, 29(4),359-372.
Lind, M. R. (2011), Information technology project performance: The impact of Critical Success Factors. *International Journal of Information Technology Project Management*, 2(4),14– 25.
Meier, S. R. (2008). Best project management and systems engineering practices in pre-acquisition practices in the federal intelligence and defense agencies. *Project Management Journal*, 39(1),59– 71.
Might, R. J., & Fischer, W. A. (1985). Role of Structural Factors in Determining Project Management Success, *IEEE Transactions on Engineering Management*, 32(2),71– 77.

Miller, R., & Lessard, D. R. (2000). *The strategic management of large engineering projects*, MIT Press: Cambridge.
Morris, P. W. G., & Hough, G. H. (1987). *The Anatomy of Major Projects*, John Wiley and Sons: New York.
Morris, P. W. G. (n.d.). *Reconstructing Project Management*, John Wiley & Sons, Incorporated, 2013. ProQuest Ebook Central.
Pinto, J. K., & Slevin, D. P. (1987). Critical factors in successful project implementation. *IEEE Transactions on Engineering Management*, 34(1),22– 27.
Pinto, J. K., & Slevin, D. P. (1989). Critical Success Factors in R&D projects, *Research Technology Management*, 32, 31– 35.
Project Management Institute (PMI) Standards Committee. *A Guide to the Project Management Body of Knowledge* (PMBOK), 1983/2004 (Project Management Institute: Newtown Square, PA).
Sapolsky, H. (1972). *The Polaris System Development: Bureaucratic and Programmatic Success in Government*. Harvard University Press: Cambridge, MA.
Schley, D. G., & Lewis, D. (2017) The Theoretical Foundations of Project Management. *Journal of Business and Economics*, 8(5).
Söderlund, J., & Lenfle, S. (2013, July). Making Project History: Revisiting the Past, Creating the Future. *International Journal of Project Management,* 653-662.
Somers, T. M., & Nelson, K. G. (2004) A taxonomy of players and activities across the ERP project life cycle. *Information & Management*, 41(3)257-278.
Songer, A. D., & Molenaar, K. R. (1997). Project Characteristics for Successful Public-Sector Design-Build. *Journal of Construction Engineering and Management*, 123(1), 34-40.
Sumner, M. (1999). Critical Success Factors in enterprise wide information management systems projects. *Proceedings of the Americas Conference on Information Systems*, Milwaukee, WI,232– 234.
Sun, H., & Wing, W. C. (2005). Critical Success Factors for new product development in the Hong Kong toy Industry. *Technovation*, 25(3),293– 303.
Tabish, S., & Neeraj Jha, K. (2011). Identification and evaluation of Success Factors for public construction projects, *Construction Management and Economics*, 29(8),809– 823.
The Standish Group. (1994). *The CHAOS Report*, http://www.standishgroup.com.
Tishler, A., Dvir, D., Shenhar, A., & Lipovetsky, S. (1996). Identifying Critical Success Factors in defense development projects: A multivariate analysis, *Technological Forecasting and Social Change*, 51(2), 151– 171.
Toor, S., & Ogunlana, S. (2009). Construction Professionals' Perception of Critical Success Factors for large-scale construction projects. *Construction Innovation: Information, Process, Management,* 9(2),149– 167.
Whittaker, B. (1999). What went wrong? Unsuccessful information technology projects, *Information Management & Computer Security*, 7(1), 23– 29.
Yeo, K. T. (2002). Critical failure factors in information system project, *International Journal of Project Management*, 20(3), 241-6.
Yu, J., & Kwon, H. (2010). Critical Success Factors for urban regeneration projects in Korea, *International Journal of Project Management*, 29(7), 889– 899.
Zakari Danlami, T., Emes, M., & Smith, A. (2016). Critical Success Factors for Projects in the Space Sector. *Journal of Modern Project Management*, 56-63.
Zwikael, O., & Globerson, S. (2006). From Critical Success Factors to Critical Success Processes. *International Journal Of Production Research*, 44(17), 3433-3449.