

Project Portfolio Management Capability: The Case of Iran's Power Industry Innovation Projects

¹Amirhossein Khameneh, ¹Mohammad Hossein Sobhiyah and ²Seyyed Hamid Khodadad Hosseini

¹Department of Project Management and Construction, Tarbiat Modares University, Tehran, Iran

²Department of Management and Economic College, Tarbiat Modares University, Tehran, Iran

Abstract: Project Portfolio Management (PPM) capabilities provide a holistic decision making framework to align projects with strategy and to ensure resource sufficiency for the project portfolio. We aim at discovering the components of PPM capabilities for innovation projects in order to respond to dynamic environments in the case of five Iranian organizations producing equipment of the power industry. Qualitative research design was chosen for this study and through using semi-structured and in-depth interviews with 24 experts in case studies, we use a grounded theory approach to develop a customized model of PPM capability for innovation projects. According to the findings from these qualitative data, PPM capability model consists of eleven areas that totally contain 81 capabilities. These eleven capability areas included process, structure, people, strategic management, ideas and proposals management, communication management, resource management, risk and uncertainty management, technology management, knowledge management and intellectual properties and innovation management. We use the focus group method by conducting workshop with senior experts for validating the proposed model. Finally, we discuss about the theoretical and practical implications of this study and provide some recommendations for further researches.

Key words: Project portfolio management, capability, innovation projects, power industry, grounded theory

INTRODUCTION

As many organizations shift to 'management by projects', projects are often the main vehicle for delivering organizational strategy. Project Portfolio Management (PPM) has gained attention as a way to enable organizations to align projects with strategy and to ensure adequate resourcing for projects (Wideman, 2004; Levine, 2005). PPM is a high-level capability that involves a range of tools and processes along with supporting organizational structures such as a portfolio review board or a portfolio management office. PPM capabilities can improve organizational flexibility and performance by providing a holistic and responsive decision-making environment.

While PPM capabilities often have common elements, they cannot be easily transferred or acquired. There is an order of implementation to many aspects of a PPM capability and the capability must be developed over time (Eisenhardt and Martin, 2000; Cooper *et al.*, 2001).

PPM is a high-level capability in which managers engage with a range of processes, methods and tools for

ongoing resource allocation and reallocation among a portfolio of projects to maximize their contribution to the overall welfare and success of the enterprise. These processes often involve supporting organizational structures such as a portfolio review board and/or a Project Management Office (PMO) or Project Portfolio Management Office (PPMO). The aim is to improve project success rates by providing a holistic and responsive decision-making environment to maximize the long-term value of the project portfolio.

In this regard, we conducted personalized interviews in order to gain a deeper understanding of PPM capabilities in literature and case studies findings (Eisenhardt, 1989). Using a qualitative research design and following grounded theory facilitates an interpretive approach, understanding the context of phenomena, identifying unanticipated phenomena and influences and generating new "grounded" theories (Holloway, 1997; Maxwell, 2005; Glaser, 2010). Therefore, we conducted 24 interviews in 5 Iranian organizations producing equipments of the power industry. This study proceeds as follows. First, we present a short literature review on

PPM with a particular focus on PPM capabilities. Applying a coding system as well as a grounded theory approach, we develop a customized model regarding the PPM capabilities consist of eleven areas that totally contain 81 capabilities. This study is concluded with a discussion of our findings, limitations as well as implications for management practice and further research.

Literature review

Theoretical background: In recent years, many efforts have been made in Iranian power industry to achieve expertise and technology in various fields, including the design and manufacture of required equipments. The result of these efforts has been the development of domestic production and self-sufficiency in some areas, increased employment, reduced outflow of currency and even export of electricity. Nevertheless, the rate of innovation in this industry is far from optimal and there are many problems in the way of innovation (from generating ideas to making the final product).

Implementation of PPM in the studied companies requires actions such as good analysis of the market, proper prioritization of projects and resources in the organization, recognition of the right time to release the product to market, analysis and categorization of projects, application of risk management system for portfolio risk assessment and will increase the success rate of these projects.

Therefore, the main problem of this study is the low performance of NPD projects due to the dynamic environment of power industry, the existing challenges, the need for innovation project portfolios and NPD and their effective management in order to achieve competitive advantage in the organizations. Therefore, it seems essential to identify PPM capabilities as a guideline for organizations to improve the success rate of their new products.

The modern perception of portfolio management is mainly based on the finance-oriented portfolio theory by Markowitz (1952) and Galloppo (2010). Since then, portfolio management has gained increasing importance in industrial application and especially in innovation management. There is growing awareness and application of portfolio methods in practice and Hunt and Killen (2008) state that portfolio management is a rapidly developing field of research and practice. The importance of PPM is grounded in the firm's ongoing challenge to balance its available resources with its number of projects (Cooper *et al.*, 1999). PPM is important because of the rapidity at which resources are consumed in the innovation process and the need to control this consumption.

Although, PPM has become an established term in many environments, the terms "project portfolio" and "portfolio management" are not uniformly understood and used (Jamieson and Morris, 2004; Srivannaboon and Milosevic, 2006). Using the Project Management Institute (PMI) definitions as a base, definitions of PPM and related terms have been developed to suit the new product development environments studied. The PMI defines a portfolio as: "a collection of projects or programs or other work that are grouped together to facilitate effective management of that work to meet strategic business objectives. The projects or programs of the portfolio may not necessarily be interdependent or directly related" (PMI, 2013). A portfolio of projects is therefore a strategic grouping of projects and programs. Programs are a more tactical grouping of "related projects managed in a coordinated way to obtain benefits and control not available by managing them individually" (PMI, 2013). For this research, the project portfolios studied are defined as "a collection of new product development projects and/or programs that are managed centrally to meet strategic business objectives".

In this context, "innovation projects" are used to develop new products including new manufactured products; new services products or combination of manufactured and services products. These projects can be defined in three areas including "product development", "development of technology and processes" and "product improvement". Any organization is able to define and implement a portfolio of those projects.

PPM capabilities: An organization's PPM capability provides a holistic perspective for decision making to ensure that the project portfolio aligns with the strategy and provides the best organizational outcomes. The effectiveness of a PPM capability is ultimately determined by the level of financial return that is sustainably generated from project portfolio investments. Other more immediately accessible measures of PPM effectiveness that are associated with high returns in the long run are a high degree of alignment between strategy and projects, a good balance of project types and the availability of adequate resources for projects (Cooper *et al.*, 2001, Killen *et al.*, 2008a).

Killen *et al.* (2008b) defined PPM capabilities as an organizational capability including PPM structures, PPM processes and PPM people which influence the effective implementation of PPM processes. Fig.1 presents these three elements.

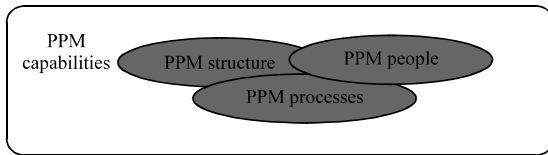


Fig. 1: Three elements of PPM capabilities (Killen *et al.*, 2008b)

PPM structures: includes organizational structure to support PPM capabilities. PPM structures involve the review board of project portfolios as well as the roles defined for PPM. PPM structure improves a holistic vision in the level of portfolio, responsibilities and accountability for PPM (Killen *et al.*, 2008b).

PPM processes: involves practices, experiences, procedures, methods and tools which are used by managers for continuously allocation and reallocation of resources among a portfolio of innovation projects in order to increase the level of participation in the ultimate success of organization. These processes are used for centralized coordination of projects within the portfolio (Killen *et al.*, 2008b).

PPM people: involves people and cultural aspects required to support PPM capabilities. PPM people refers to organizational culture, people skills, incentive systems of participants in PPM as well as the role of politics and management support for PPM. In fact, this component involves activities which develop human resources of an organization for the best support for PPM capabilities. Aside from structures and processes, people are responsible for PPM capabilities and group decisions essential for PPM capability (Killen *et al.*, 2008b).

The type of organizational structures and processes used for PPM varies among organizations and there is no standard structure or process that is required for an effective PPM capability. Research repeatedly indicates that although, there are common elements such as financial measures, strategic checklists or portfolio visualization techniques in many PPM processes; each organization must customize and adapt their PPM process to their individual situation (Loch, 2000; Cooper *et al.*, 2001; Killen *et al.*, 2008b). Empirical research has also shown that PPM capabilities are an important mechanism for alignment of project activities with strategy (Poskela *et al.*, 2005; Dietrich, 2006; Srivannaboon and Milosevic, 2006).

The case studies reported in this study reinforce these earlier findings and also added some capability areas to existing literature and proposed a customized model for PPM capabilities in case of innovation projects.

Research question: According to above mentioned literature reviews and existing studies about PPM and its capabilities, our main research question are as follows: RQ: What are the elements of an organization's PPM capability for innovation projects?

MATERIALS AND METHODS

Research design: A qualitative research design was chosen to achieve the research goals of gaining a deeper understanding of PPM capability in general and its practical implication through personal interviews (Eisenhardt, 1989). Using a qualitative research design and following a grounded theory approach facilitates an interpretive approach, exploring and understanding the context of phenomena, identifying unanticipated phenomena and influences and generating new grounded theories (Holloway, 1997; Maxwell, 2005; Glaser, 2010). The openness and flexibility of qualitative approach allows for the modification of design and focus during the research and enhances the researcher's understanding of new discoveries and relationships (Maxwell, 2005). Therefore, the chosen qualitative approach is useful to uncover the contextual dimensions of PPM capability and to develop customized model addressing the practical applications and implications of PPM (Miguel, 2008).

Data collection: This study investigates IPPM by means of 24 semi-structured and in-depth interviews in 5 Iranian organizations in the field of manufacturing and production of equipments in the power industry during 2014-2015. However, any organization is leading and successful in its industry in at least a 5 year period. Table 1 gives overview information on the companies' characteristics.

The experts which participated in interviews included NPD and Rand D project portfolio managers, Rand D managers, business development managers, Rand D project expeditor and product development managers. In addition, to the publicly available documents as well as confidential documents, internal memos and process diagrams were analyzed and reviewed to understand the role of PPM capability in overall organization.

The sampling method used for semi-structured and in-depth interviews was snowball sampling. Theoretical sampling was used for sampling adequacy. For the purpose of triangulating and to ensure the validity of the identified factors, the interviews were reviewed several times by the researcher and once by the independent expert.

We asked open questions as well as theory-driven questions that refer to the scientific literature (Flick, 2009).

Table 1: Overview of Companies

Company	Industry specific field	Types of innovation projects	Employee	Role of interviewees
1	Turbines and related auxiliary equipments for power plants	Product, Services, Processes, technology	>1,000	Engineering deputy, R and D manager, Technology Manager
2	Generators and related auxiliary equipments for power plants	Product, Services, Processes, technology	>1,000	R and D manager, product development manager
3	Turbines blades for power plants	Product, Services, Processes, technology	>500	R and D manager, product development manager
4	Electrical and Control Systems for power plants	Product, Services, Processes, technology	>300	Product development deputy, Head of R and D management
5	Steam Boilers for power plants	Product, Services, Processes, technology	>500	R and D manager, engineering deputy

The open questions accounted for the openness, flexibility and iterative character of grounded theory methods. Thereby, we were able to also focus on emergent and unanticipated phenomena in our interviews and so build up a customized model of PPM capability. This strategy for data collection helped to enhance the quality of the discussions and increased the efficiency of our interviews (Merton and Kendall, 1946; Flick, 2009). Each interview took about 45-70 min. The interviews were audio taped and transcribed by a professional transcription service.

Data analysis: Interview data's were analyzed with the help of ATLAS.ti software, using the grounded theory approach (Strauss and Corbin, 1998; Creswell, 2007). Using the grounded theory framework, data were analyzed and represented in three steps: open coding, axial coding, selective coding (Creswell, 2007). Following the systematic comparative approach by Strauss and Corbin (1998), the analysis was iterative. Knowledge from the literature was compared to findings from the interviews and there by, led to more specific theoretical explanations (Strauss and Corbin, 1998). After organizing the data and making initial notes, we used an open-coding process to identify concepts (Strauss and Corbin, 1998).

The main issue during this coding process is to identify the main idea brought out in each sentence or paragraph. In the following step, codes are summarized into categories, grouping certain ideas and events (Strauss and Corbin, 1998). Through this process, we identified certain central phenomena and engaged in the axial-coding process which was used to review and analyze the data in order to identify specific coding categories that explain central phenomena (Creswell, 2007). This coding is shown in Table 2.

We discussed the results during a workshop conducted with the majority of our interviewees. Thereby, we confirmed the correctness and practicability of our results, even though the summarized results did not necessarily reflect each single opinion.

Table 2: PPM capabilities elements

Category	Capability Areas (theme)	Code	No. of capabilities
Innovation	Process	PR	9
Project Portfolio	Structure	ST	6
Management	People	PE	16
Capabilities	Strategic Management	SR	6
	Ideas and Proposals Management	IP	4
	Communication Management	CO	8
	Resource Management	RE	7
	Risk and Uncertainty Management	RI	4
	Technology Management	TE	7
	Knowledge Management and Intellectual Properties	KM	5
	Innovation Management	IN	9

RESULTS AND DISCUSSION

Our analysis of literature shows that so far PPM capability is mostly seen as being dependent on the structure, people and process in use. However, interviews revealed that other elements, such as strategic management, ideas and proposals management, communication management, resource management, risk and uncertainty management, technology management, knowledge management and intellectual properties and innovation management also constitute the PPM capabilities: RQ asked "What are the elements of an organization's PPM capability for innovation projects?"

The themes identified during the qualitative data analysis reveal that an organization's capability for PPM encompasses much >the process, structure and people. The findings from the case studies are summarized next in eleven capability area.

Companies strive for finding ways on how to further develop their PPM capabilities and how to set up routines and processes. The study extends current empirical research (Cooper *et al.*, 1999; Kester *et al.*, 2011a) by identifying eleven capability areas which are applicable for innovation projects in case of Iran's power industry. These findings resulted in 11 capability area, forming the basis of our theoretical model (Fig. 2).

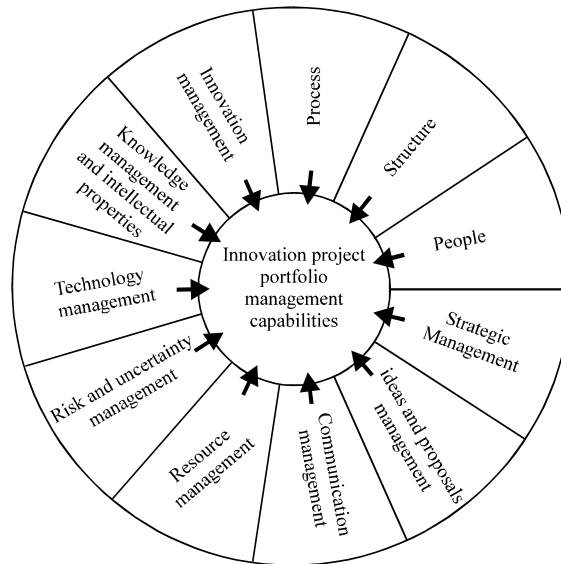


Fig. 2: PPM capability model

Capability areas

Area 1) Processes: This area mainly deals with processes that used in managing innovation projects and portfolios and consists of 9 capabilities. These capabilities including items such as: PPM processes, customized processes for NPD projects, evaluation criteria for different NPD stages and selecting new projects using PPM criteria. As one manager stated that the stage-gate approach for NPD projects was authorized in our company and engineering deputy is responsible for it and they almost implement this approach in all projects. Considering nature, scope and schedule of any project; we modified the processes and made some changes in the gates” (Company 4).

Area 2) structure: This area specifically related to organizational structure which established in company and used for portfolio governance and consists of 6 capabilities. These capabilities including items such as: Unit in charge of the PPM process, portfolio review board, roles and responsibilities and the organizational structure supports the PPM process. As one manager stated that Portfolio management was directed at top level managers and strategic planning deputy in company. At operational level; the Rand D deputy are responsible for the related activities and processes. Also, some technical committees with transparent roles are participating in decision making with this department.” (Company 2).

Area 3) people: This area mainly deals with staffs that involved in managing innovation projects and portfolios and consists of 16 capabilities. These capabilities

including items such as: Supportand commitment of top management organizational culture supports PPM, staff capability profiles, Future projections for staff capability and anticipated requirements, promoting an innovative organizational culture with a strategic long-term orientation and reward mechanismsto support PPM processes. As one manager stated that “[. . .] in my opinion the CEO has significant roles in implementing PPM in organization. Otherwise, the staffs don’t make any attention to processes and important evolutions never occur” (Company 5).

Also in this regard, another manager mentioned that: “[. . .] at first we must make specific attention to innovative culture. Because it was a big organizational changes in company. Then we must prepare required infrastructures and incentive systems for implementing the PPM” (Company 3).

Area 4) strategic management: This area specifically related tostrategic issues which should be considered in implementing PPM in company and consists of 6 capabilities. These capabilities including items such as:Market study process, using NPD strategy in decision makings, considering portfolio balance criteria in NPD strategy and executing NPD strategies. As one manager mentioned that “[. . .] all projects were approved and authorized by “product development committee” in our company. This committee contains top managers form different disciplines and they will check projects with strategies and then make a decision on approving or rejecting them” (Company 1).

Area 5) ideas and proposals management: This area mainly deals with processes that used in managing innovation projects and portfolios and consists of 4 capabilities. These capabilities including items such as: collection of ideas and selecting into the project proposal, generation a variety of ideas, encouragement and motivation in higher diversity of idea generation and reviewed and updated the idea generation and management processes. As one manager stated that “[. . .] one of our action plans in year 2015 in RandD deputy is to improve the idea gathering system based on staffs’ feedback on current system. We organize to develop a web-based system on next year” (Company 5).

Area 6) communication management: This area generally related to diverse communications about tools and practices used in PPM that should be done within organization and consists of 8 capabilities. These capabilities including items such as: informing and regularly updating the PPM process and project portfolio information throughout the organization, proper communication plan, interactive research cooperation with institutes and universities and effective cooperation and communication with customers. As one manager mentioned that “[. . .] In order to getting feedback from different parties in organization about PPM, we develop an IT-Based platform for communicating project information between head office and contractor and team members” (Company 2).

Area 7) resource management: This area mainly deals with considerations about resource planning and timing for projects and portfolios and consists of 7 capabilities. These capabilities including items such as: project proposal criteria and PPM criteria for project resource allocation, a portfolio level analysis of resource usage, considering future projections in resource planning and timing, development of resources based on the project portfolio analyses and existing of laboratory facilities and infrastructures. As one manager stated that “[. . .]at one point we must check the portfolio status. In some cases due to lack of financial resources or misalignment with strategies, some projects should be hold and we must transfer our staffs, machinery and money to other projects” (Company 3).

Area 8) Risk and Uncertainty Management: This area specifically related to risks issues which should be considered at project and portfolio levels in company while performing the innovation projects and consists of

4 capabilities. These capabilities including items such as: project risk management, portfolio risk management, considering project complexities and solving sanction problems. As one manager mentioned that “[. . .] in research projects we have many uncertainties and unknowns in knowledge, technologies and required facilities which is the nature of this type of projects. So, we should implement a particular risk management for our projects” (Company 4).

Area 9) technology management: This area generally deals with some issues about technology foresight required for innovation projects and consists of 7 capabilities. These capabilities including items such as: technology monitoring, technology roadmap, technology commercialization and promoting the technology and production processes. As one manager stated that “[. . .]it is very essential thing that we could future study for new technologies and market needs. In this regard we establish new department in our structure and draw our next 5 year technology roadmap” (Company 1).

Area 10) Knowledge Management and Intellectual Properties: This area mainly focused on managing project documents, knowledge and assets and consists of 5 capabilities. These capabilities including items such as: Knowledge and technology transfer, managing of intellectual properties, managing of knowledge and technology, lessons learned management system and documentation system for innovation projects. As one manager mentioned that “[. . .] we believe that information and documents are the primary results of projects and deem as a capital asset for organization. The Document Management System (DMS) established in company facilitates the storage and management of any project’s electronic files. This system are implemented is SAP solution and can be connected to other SAP modules” (Company 5).

Area 11) innovation management: This area generally related to managing dynamic changes in environment and the ways that organization can acquire required knowledge for their projects and consists of 9 capabilities. These capabilities including items such as: Identifying technical and economical changes, knowledge acquisition from external the organization, internal technology creation, managing NPD projects, implementing technical and non-technical changes.

CONCLUSION

Contribution: PPM capabilities are increasingly relied upon by organizations to provide a holistic

decision-making framework to align projects with strategy and to ensure resource sufficiency for their project portfolios. In dynamic environments such as NPD, PPM can act as a dynamic capability and provide competitive advantage by enabling organizations to effectively respond to changes in the environment. Based on our qualitative analysis, we proposed a Capability Model, building a potential foundation for further research on PPM. We were able to identify the eleven elements of PPM capabilities as key area drivers of PPM.

Designing PPM methods and processes is an ability companies need to possess in order to increase innovation outputs and achieve competitive advantages (Ellonen *et al.*, 2009). Furthermore, we learned about the PPM's importance as an ability or process to allocate resources to the most beneficial projects in a multi project environment. Also, we find out that PPM can be understood as the capability to acquire and control resources in order to set up an organization that can absorb and apply these resources to achieve competitive advantage (Kraaijenbrink *et al.*, 2010).

The qualitative research design was appropriate for gaining an in-depth understanding the PPM capabilities in case organizations. Our interviews revealed the importance of integrating model consist of the eleven PPM capability areas.

LIMITATIONS

This study provides model aiming at enriching the current understanding of PPM capabilities and developing a basis for further research. Although, the richness arising from qualitative research design and the appropriateness of an inductive approach for our purposes is key strengths of this study, the results are limited due to the research design in terms of its representativeness, unavoidably retrospective nature and potential informant biases. To minimize potential informant biases, we conducted two or three interviews in most of the companies. While our findings may be partial and biased, they still constitute the interviewees' reality in the firms and constitute the basis for their future action. We provide a broad picture by conducting 24 interviews in 5 companies from different Iran's power industry sectors and provide a model for future studies to build on. We sought to make our analysis and judgments as transparent as possible in order to validate the findings.

RECOMMENDATION

In conclusion, this study contributes new insights to the emerging research on PPM capability. While most

PPM literature is still atheoretical, our study develops PPM capability in the context of the Iran's power industry.

However, while these findings are consistent across five organizations that were chosen to represent a diverse set of power industry companies, further research is required to determine whether the findings are generalizable across other organizations and industries. Therefore, these results will require validation by further studies. For example, a survey of a larger sample of organizations could be used to test the model or a longitudinal study could be used to capture in-depth information about PPM capability and the evolution of them over time.

Also, the PPM capability model can be used for future studies investigating the linkages between PPM performance and identified capabilities as independent and firm and project performance as dependent variable. Consequently, our study provides a basis model for future empirical research in other industries in developing countries which will potentially have significant implications for academia and managerial practice.

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