

**Manuscript of paper published in :
International Journal of Managing Project in Business
Volume 1, Issue 3, 2008, pp 334-351**

Learning investments and organisational capabilities: Case studies on the development of project portfolio management capabilities.

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Research Paper

Keywords: Project Portfolio Management, Project Management, Strategy, Dynamic Capabilities, Organisational Learning, Innovation.

Structured Abstract

Purpose

The purpose of this paper is to improve understanding and provide guidance for investments in organisational learning mechanisms for the establishment and evolution of organisational capabilities such as project portfolio management (PPM) and project management capabilities.

Methodology/Approach

A multiple-case study research project investigates the development of PPM capabilities in six successful organisations across diverse industries.

Findings

The research indicates that PPM and organisational learning are dynamic capabilities that enhance an organisation's ability to achieve and maintain competitive advantage in dynamic environments. PPM capabilities are shown to co-evolve through a combination of tacit experience accumulation, explicit knowledge articulation and explicit knowledge codification learning mechanisms. Although all three learning mechanisms are important throughout the establishment and evolution of PPM capability development, the research indicates that the development of an effective PPM capability will require particularly strong investments in enhancing tacit experience accumulation mechanisms and explicit knowledge codification mechanisms during the initial establishment or during periods of radical change to the PPM process.

Research limitations/implications

The research includes a sample of six case studies and the results may not be generalisable. In addition the research was conducted over a short period of time whereas a longitudinal study would be required to gain more detailed information about the development of capabilities over time.

Practical implications

The findings suggest that managers can enhance and sustain competitive advantage by investing in tacit experience accumulation as well as explicit knowledge articulation and codification learning mechanisms to develop their PPM capability. Strengthened investment in experience accumulation and knowledge codification learning mechanisms is recommended during establishment of the PPM capability.

Originality/value of paper

This paper contributes to the understanding of the links between organisational learning and the development of dynamic capabilities. Original hypotheses are proposed and some initial support for these hypotheses is provided through multiple-case study research.

Introduction

Two central questions explored in the literature on organisations and competitiveness are “Why do some organisations compete more successfully than others?” and “What can organisations do to enhance and sustain their competitive advantage?” As organisational activity is becoming increasingly project-based these questions as they relate to the management of projects are particularly relevant. This paper uses a dynamic capabilities perspective to improve understanding of how project portfolio management (PPM) capabilities contribute to organisational competitive advantage. Examples from a multiple-case study focusing on the PPM capabilities in six successful Australian organisations are used to illustrate the application of learning investments for the establishment and evolution of PPM and project management capabilities and to lend support for hypotheses on the relative effectiveness of different types of learning investments.

This paper first discusses PPM capabilities to provide an understanding of what PPM is, how it relates to project management, and how it is done. An overview of strategic frameworks and theories is then provided, concentrating on dynamic capabilities such as PPM capabilities and organisational learning capabilities that enhance an organisation’s ability to maintain competitive advantage in dynamic environments. The theories and hypotheses developed to understand the relationship between organisational learning investments and dynamic capabilities are introduced followed by an outline of the multiple-case study research method used to test the hypotheses. Finally this paper concludes with a summary of the findings and suggests directions for future research.

PPM Capabilities

An organisation’s PPM capability provides a holistic perspective for decision making to ensure that the project portfolio aligns with the strategy and provides the best organisational 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., 2008).

Although PPM has become an established term in many environments, the terms ‘project portfolio’ and ‘portfolio management’ are not uniformly understood and used (Milosevic and Srivannaboon, 2006, Morris and Jamieson, 2005). 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, 2006:78). 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, 2006:p4). 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”.

A wide organisational perspective is used for this research, and a PPM capability is defined as an organisational capability that consists of a combination of the organisational structures, the specific processes, and the people that are involved in managing the project portfolio. The specific processes include commonly identified PPM activities such as “identifying, prioritizing, authorising, managing and controlling projects” (PMI, 2006:5) as well as organisational learning activities that ensure that the PPM capability is dynamic and responsive to the changing environment. PPM is a high-level capability that usually involves a team of strategic decision makers. An established project management capability consisting of a structured process with defined phases and decision points is a prerequisite for an effective PPM capability (Martinsuo and Lehtonen, 2007). The combination of the project management and PPM capabilities enables the organisation to gain the maximum value from project investments (Cooper et al., 2001, Dawidson, 2004, Pennypacker and Sepate, 2005). Figure 1 illustrates a typical PPM capability and shows the relationship between the PPM processes, people and structures and the project management processes.

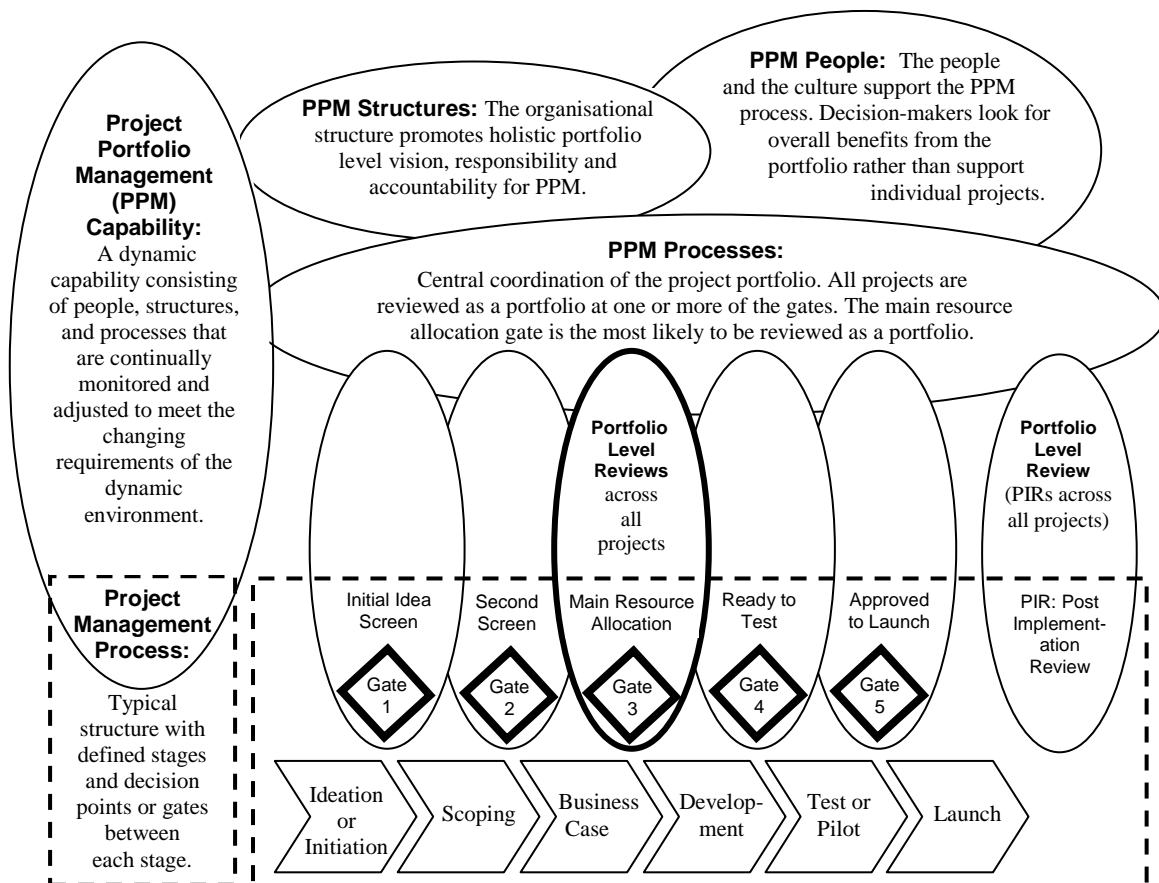


Figure 1: PPM Capability components and the integration between PPM and Project Management processes
[derived from (Cooper et al., 2001:291)]

The type of organisational structures and processes used for PPM vary among organisations 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 visualisation techniques in many PPM processes; each organisation must customise and adapt their PPM process to their individual situation (see for example Cooper et al., 2001, Killen et al., 2008, Loch, 2000). Empirical research has also shown that PPM capabilities are an important mechanism for alignment of project activities with strategy (Dietrich, 2006, Milosevic and Srivannaboon, 2006, Poskela et al., 2005).

The case studies reported in this paper reinforce these earlier findings and also support the notion that organisational learning plays a strong role in the development of organisational capabilities. Learning processes promote the continual evolution and adaptation of the PPM capability to keep it aligned with the changing competitive environment.

Organisational Capabilities and Strategy

PPM capabilities focus on the decisions about how best to spend or invest resources that are central to organisational strategy. Strategic frameworks, in particular those based on the resource-based view (RBV) and dynamic capabilities help to explain how PPM capabilities can enhance competitive advantage.

In the past few decades strategic literature has been dominated by approaches focused on the competitive environment and strategic conflict and positioning such as Porter's competitive forces approach (Porter, 1980). This external focus does not fully explain why some organisations are more successful in these markets than others, and does not help organisations to understand how to develop sustainable competitive advantage (Teece et al., 1997). To better understand the organisational basis for competitive success, the RBV (Smith et al., 1996, Wernerfelt, 1984, Wernerfelt, 1995) or core competency models (Prahalad and Hamel, 1990) of organisational advantage offer internally-focused frameworks that have gained popularity.

A significant aspect of organisational strategy is the identification, development and maintenance of the important organisational resources that underpin competitive advantage (O'Regan and Ghobadian, 2004). The RBV assumes that resources are not uniform across competing organisations and uses this heterogeneity to explain the differing organisational success rates. Resources that are valuable, rare, inimitable and non-substitutable form the best basis for sustainable competitive advantage by being difficult for other organisations to copy or acquire (Barney, 1991).

Some of the RBV literature refers to resources and capabilities interchangeably, while others distinguish between them (Ethiraj et al., 2005). This paper defines 'capabilities' as a specific type of organisational resource that enables the organisation to deploy other resources to perform activities that result in desired outcomes (Amit and Schoemaker, 1993, Teece et al., 1997). While some types of resources can be bought and sold, valuable resources like capabilities cannot easily be transferred from one organisation to another (Makadok, 2001). Capabilities therefore need to be developed within an organisation and tailored specifically for that organisation. Capabilities are developed through organisational routines and involve the development, collection and exchange of information. Therefore organisational learning plays a strong role in the development of organisational capabilities (Moingeon and Edmondson, 1996).

Dynamic capabilities have been identified as a class of organisational capabilities that enable organisations to effectively respond to changes in the dynamic environments in which they compete (Eisenhardt and Martin, 2000, Teece et al., 1997) or as a "behavioural orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage" (Wang and Ahmed, 2007:35). By viewing dynamic capabilities as a class of organisational capability, the focus is primarily on the processes used in organisations to integrate, build and reconfigure their resources to compete in dynamic environments. In this way, a dynamic capability can be defined as a "pattern of collective activity through which the organisation systematically generates and modifies its operating routines in pursuit of competitive advantage" (Zollo and Winter, 2002:340). In contrast the view of a dynamic capability as a 'behavioural orientation' focuses more on the learning aspects embedded in the processes (Wang and Ahmed, 2007). Three component factors of dynamic capabilities that emphasise learning-based behavioural orientations are: adaptive capacity (the ability to identify and capitalise on emerging market opportunities), absorptive capacity (the ability to identify and integrate new external knowledge with existing internal knowledge for competitive gain), and innovative capacity (the ability to develop new products and/or markets) (Wang and Ahmed, 2007).

This paper's view of dynamic capabilities emphasises the fact that dynamic capabilities must be dynamic and adaptive in order to provide sustainable benefits in a dynamic environment. Therefore dynamic capabilities that possess a learning orientation with a strong absorptive capacity are well placed to ensure that the capability remains a dynamic capability by continually evolving in response to changes in the environment. Dynamic capabilities also require the existence of other resources and capabilities to deliver competitive advantage (Teece et al., 1997), and play an important role in allocating resources as well as in identifying the desired development and direction of resources and capabilities in line with strategy (Killen et al., 2007, Wang and Ahmed, 2007).

PPM and organisational learning: dynamic capabilities

This study focuses on PPM practices as an organisational capability and draws upon the RBV and dynamic capability frameworks in order to help explain how PPM capabilities influence organisational competitiveness. Organisational routines such as PPM processes are a dynamic capability due to the role they play in the organisation's ability to continually align projects to the evolving organisational strategy. PPM decisions determine which innovation activities an organisation will undertake and affect the longer term development, acquisition and retirement of organisational resources to support the strategy. In this way, the PPM capability draws on the existing resources and capabilities of an organisation while also helping to develop these resources and capabilities (Cepeda and Vera, 2007, Wang and Ahmed, 2007).

The dynamic capabilities strategy framework shows how PPM capabilities help organisations create and maintain organisational competitive advantage in dynamic environments and helps to explain the emphasis that organisations are currently placing on organisational learning investments for the establishment, development and improvement of their PPM capabilities. An organisational learning capability enables the organisation to obtain, process, interpret and respond to information and to change organisational behaviours to generate opportunities and improve organisational outcomes (Easterby-Smith and Araujo, 1999, Senge, 1990). Learning capabilities can be considered a type of dynamic capability due to their role in shaping other organisational capabilities (Zollo and Winter, 2002). From a capability hierarchy perspective, organisational learning capabilities can be viewed as 'second-order' dynamic capabilities due to their role in the creation and evolution of other dynamic capabilities that are considered 'first-order' due to their ability to change other operational capabilities (Winter, 2003). This hierarchy is evident in recent research where a knowledge management capability (a 'second-order' dynamic capability) is shown to support the development of other ('first-order') dynamic capabilities in the IT industry (Cepeda and Vera, 2007).

The organisational learning processes that support the development of dynamic capabilities are also beginning to attract the attention of researchers (see for example Cepeda and Vera, 2007, Easterby-Smith and Prieto, 2007, Zollo and Winter, 2002). Research into PPM practices regularly acknowledges the evolution and development of these practices within an organisation. For example, PPM processes are shown to be on an evolutionary path through maturity models developed based on empirical 'best practice' focused research studies (Crawford, 2007, Jeffery and Leliveld, 2004, Kahn et al., 2006). In addition, a majority of recent survey respondents feel that PPM capabilities are valuable and intend to invest in further developments and improvements of their PPM capabilities (Center for Business Practices, 2005, Dye, 2006, Kapur et al., 2006).

Tacit as well as explicit organisational learning mechanisms have an important role to play in the establishment and evolution of dynamic capabilities as they need to be updated repeatedly in order to respond to changes in the environment (Zollo and Winter, 2002). Organisational learning and knowledge development are dynamic processes that require organisational structures and processes to be effective. The knowledge 'spiral' relies on an organisational capability to mobilise the tacit knowledge (i.e. the learning that is embedded within individuals and not yet articulated or codified) to create organisational knowledge (Nonaka, 1994). Individual learning is the primary genesis of organisational knowledge, including the knowledge embedded within dynamic capabilities like the PPM capability. Through the knowledge spiral, dynamic capabilities are continually developed and refined in a process where individual knowledge is explicitly articulated, amplified, codified and re-codified on an ongoing basis.

An organisational learning capability is a pre-condition for the development and evolution of a sustainable PPM capability as it enables an organisation to learn and adapt. Without an organisational learning capability, the PPM processes would become static routines and would fail to dynamically adapt to changes in the environment.

Deliberate learning investments

Of particular interest to managers is what actions they should take to build important organisational capabilities and therefore enhance their organisation's competitive advantage (Amit and Schoemaker, 1993, Ethiraj et al., 2005). The establishment and evolution of a PPM capability can be promoted through deliberate investments in learning activities that strengthen tacit and explicit learning mechanisms. Learning activities can be targeted to improve tacit learning mechanisms, for example by creating an environment conducive to the socialisation of ideas and development of knowledge. Learning activities can also be designed to enhance explicit learning mechanisms by creating structures for the amplification, capture and codification of knowledge. In this way, organisational knowledge is embedded and institutionalised within the organisation while continually developing (Nonaka, 1994). Investments in learning activities can also improve knowledge flows which may otherwise be restricted by the tendency of tacit knowledge that is internalised within individuals to be 'sticky' i.e. difficult to transfer within organisations (Szulanski, 1996). An understanding of the relative effectiveness of different learning mechanisms will assist managers to invest in the most appropriate learning activities.

Zollo and Winter (2002) propose that dynamic capabilities co-evolve through three types of learning mechanisms: tacit experience accumulation, explicit knowledge articulation and explicit knowledge codification. Organisational routines and capabilities have traditionally been thought to develop mainly through tacit experience accumulation learning mechanisms such as trial and error and the selection and retention of past behaviours (Zollo and Winter, 2002). Experience accumulation will occur without specific investment in the learning process, however learning investments can enhance the effectiveness of the experience accumulation process and can serve to 'enlarge' the individual's ability to develop knowledge (Nonaka, 1994). For example, investments in organisational restructuring to create a place within the organisation where experience can accumulate or in creating incentives for stability in the workforce will enhance the experience accumulation process.

In addition to tacit experience accumulation, explicit learning mechanisms such as knowledge articulation and codification mechanisms contribute to the development of dynamic

capabilities (Nonaka, 1994, Zollo and Winter, 2002). These types of learning are theorised to be especially valuable when the tasks are infrequent, highly variable or when the links between the decisions or actions taken and the desired performance outcomes are obscured (Zollo and Winter, 2002). An example of a deliberate learning investment to enhance knowledge articulation is the allocation of time and effort for meetings and knowledge sharing sessions. Deliberate learning investments to enhance knowledge codification involve activities like the development of a procedures manual or a software application.

Figure 2 illustrates the relationship between learning investments and the effectiveness of PPM capabilities. Learning investments are used to enhance the effectiveness of the three types of learning mechanisms that develop the dynamic capability for PPM (Zollo and Winter, 2002). Learning investments also develop the project management capability that supports the PPM capability (Ethiraj et al., 2005). The outcomes from effective learning investments will be an aligned, high value, balanced and adequately resourced project portfolio that will provide the highest return on both the learning investment and the project investment.

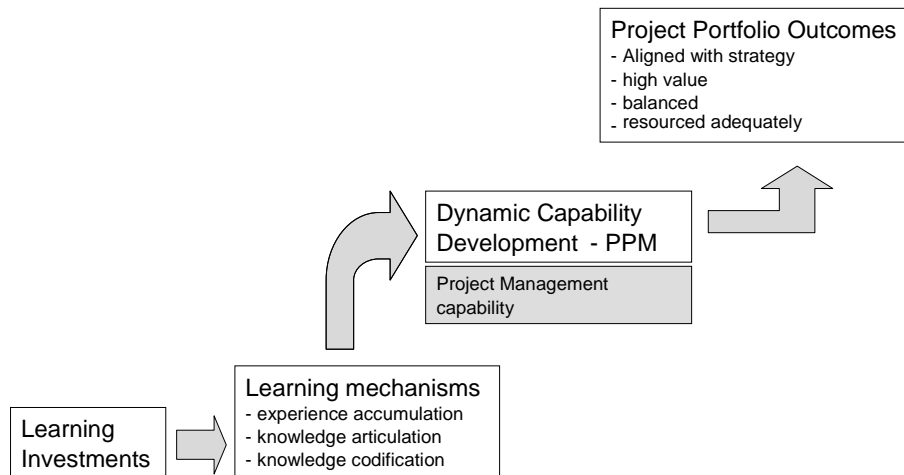


Figure 2: Learning investments, capability development and outcomes

[adapted from Zollo and Winter (2002:340)]

The role of establishment and evolution

In this paper, we theorise that the types of organisational learning investments that will be most effective in the development of a dynamic capability are dependent on the area of emphasis for the development. For the analysis two main areas of emphasis for the development of the PPM capability are identified: establishment and evolution. These two areas of emphasis and the types of activity associated with each area are found in different proportions depending on the degree of change and the stage of PPM maturity.

Emphasis on establishment is strongest when an organisation explicitly recognises the need to acquire a PPM capability and engages deliberate actions towards this end. Strong establishment activity usually signifies the initial introduction of the capability to the organisation; however it can also signify a major change in the capability that involves a re-building or replacement of the main elements of the capability.

Once a dynamic capability is established, the emphasis is generally focused on continual evolution. During evolution the capability is monitored, evaluated, modified and adjusted as

required. This evolution is necessary for the capability to stay relevant and to continue to enable the organisation to respond to changes in the environment.

Hypothesis development

The three learning mechanisms identified by Zollo and Winter (2002) are discussed here with respect to their role in establishment and evolution of a PPM capability. Hypotheses are proposed relating the relative effectiveness of these learning mechanisms to the area of emphasis (establishment or evolution) of PPM development.

Tacit experience accumulation

Learning investments that enhance tacit experience accumulation learning mechanisms are especially important when establishment activity is the focus of the dynamic capability development. When a new capability is created, an initial investment is usually required to alter the organisational structure and to create an organisational locus for the activity. This type of investment will ensure that the new capability has ownership and visibility within the organisation, and that as experiences accumulate they are more likely to be captured and used to enhance the capability. In addition, the explicit learning mechanisms of knowledge articulation and codification require this organisational locus and visibility before they can be effective (Zollo and Winter, 2002). Learning investments that occur early in the establishment of most PPM processes include actions that enhance tacit experience accumulation for PPM such as making organisational structure changes to create a locus for the processes or to raise the level of importance or visibility of the processes, or determining the membership of the multi-functional decision making groups such as the portfolio office or portfolio review board. Once the capability is established, learning investments to enhance tacit experience accumulation will have reduced impact as the organisational locus will be established and experienced staff will be on hand. However, a lower level of investment in tacit experience accumulation remains effective when the emphasis on establishment is low. Ongoing learning investments to enhance tacit experience accumulation include activities such as the creation of an environment that encourages the retention of employees (as longer serving employees can better accumulate and learn from experiences), the creation of communities of practice, or hiring employees or engaging consultants with desired experiences and attributes.

Hypothesis H1 – The strength of learning investment in tacit experience accumulation learning mechanisms required to develop an effective dynamic capability varies relative to the level of emphasis on establishment of the capability.

Knowledge articulation

Learning investments in knowledge articulation activities enhance the opportunities for the exchange of information and sharing of ideas about the PPM capability. Discussion, review, argument, and analysis are all important knowledge articulation mechanisms that assist with the development and implementation of improved capabilities. Specific learning investments to enhance knowledge articulation learning mechanisms include activities such as meetings, committees or training sessions where information is disseminated, reviewed, discussed or debated. Knowledge articulation remains important throughout the establishment and evolution of a PPM capability. For a capability to be dynamic and responsive to the environment, discussion, debate, design and re-design are required at establishment as well as during the evolution of the capability.

Hypothesis H2 – Knowledge articulation investments assist with the development of effective PPM capabilities in a relatively consistent manner independent of the level of emphasis on establishment or evolution of the capabilities.

Knowledge codification

When a PPM capability is initially established or very significantly changed, the processes, structures and policies must be documented. Maturity models and best practice studies show that in earlier stages of PPM maturity strong learning investments are required for the documentation of the process as well as initial codification of existing project data (Crawford, 2007, Jeffery and Leliveld, 2004). In addition, project management documentation must be enhanced to show the links with the PPM process during activities such as gate reviews or post implementation project reviews. Initial investments must also be made to develop procedures and systems for codifying project data which may involve the development of computer applications or tools to assist with the process. In order to capture existing project data, knowledge codification processes are required to categorise projects and incorporate the project data. Therefore when a PPM capability development is focused on establishment, knowledge codification activities are very important. Knowledge codification investments are required at a lesser intensity when emphasis on establishment is low and the codification tasks are primarily incremental updates and adjustment which are not as demanding as the initial development and setup.

Hypothesis H3 – The strength of learning investment in explicit knowledge codification required to develop an effective dynamic capability varies relative to the level of emphasis on establishment of the capability.

Method

In order to test the three hypotheses listed above, this paper presents findings from a multiple-case study research project. The case studies were conducted to develop a deep understanding of the role of PPM capabilities in organisations with a sustained innovation success record. Semi-structured interviews included a strong exploratory component to investigate the following questions: What methods are used in successful organisations to manage their project portfolio? How are PPM capabilities established and developed in these organisations and how do PPM capabilities contribute to their success?

The multiple-case study method has been chosen as it is appropriate for research into a process leading to results, where the focus is on the process rather than the outcomes (Gillham, 2000, Johnson et al., 2007). The case study research was designed to incorporate multiple perspectives and multiple sources of evidence to provide an in-depth understanding of the PPM capabilities being studied. The multiple sources also allow triangulation and increased confidence in the results (Denzin and Lincoln, 1998). The cases were conducted using overlapping data collection and analysis phases allowing incorporation of emerging themes during the process (Eisenhardt, 1989). As the final cases exhibited a diminishing marginal contribution to the analysis, the number of cases was limited to six (Gummesson, 1991).

Due to confidentiality requirements, specific details from the six organisations studied are not provided here. Each case was selected based on its sustained innovation leadership, growth or success within its industry over at least a 10-year period. The cases represent a diverse range of industries covering both intangible (service-based) and tangible (manufactured) products. In order to gain multiple perspectives of the processes and events, semi-structured interviews

have been conducted with between three and five interviewees at each organisation. Because the terms related to PPM are not uniformly understood, an explanation of PPM processes and capabilities was provided to each participant. The interviews (n = 23, average length = 110 minutes) have been conducted, transcribed and coded using NVivo software. A cross case analysis has been conducted focusing on the establishment, evolution and use of PPM practices in these organisations. Follow-up email and telephone conversations were used to clarify or follow up many of the interviews and to address emerging themes. In addition publicly available documents and publications as well as confidential documents, internal memos and process diagrams have been analysed and reviewed to understand the role of the PPM practices in the overall organisational environment.

The six organisations studied each have a minimum turnover of 700 million USD with several of the organisations achieving multiple billions of dollars in revenue. Table 1 provides an overview of the diverse range of industries represented.

Table 1: Case-study organisations and industry type

Type of Project Portfolio	Service Product Focused			Manufactured Product Focused		
Industry type	Professional Services	Tele-communications	Finance	Heavy Industrial Machinery	Medical Equipment	Building materials

This paper focuses on the findings from the research that relate to the learning mechanisms and organisational learning investments that have enabled these successful organisations to establish and evolve their project and PPM capabilities.

Limitations of the Method

As PPM capabilities are dynamic processes, a longitudinal study would best capture the evolution of these processes. The data collection for this study was done over a short period of time at each organisation and has gained a perspective of the time-dependent nature of PPM processes through questions about the past events and future plans for the establishment and evolution of the PPM capabilities. These questions have resulted in the reported findings on learning mechanisms and learning investments for PPM, however these findings are dependent on the reliability of the interviewee's memories and might possibly not be accurate. To mitigate this risk, the case studies include responses from between three and five interviewees at each organisation and the findings are strengthened by multiple recollections of the same events. In addition many of the respondents have a long history with the organisation (average 16 years) which increases the likelihood of gaining a longer term perspective. Another limitation is that no measures were made during this research to quantify the amount of effort spent on the learning investments. This study instead uses an approximate measure of the relative strength of effort applied to the identified activities based on the level of emphasis and impact evident during the interviews. Future research that focuses on a longitudinal study of PPM establishment and evolution is required to gain a more accurate record and measurements of the learning investments applied to the process.

Findings

One of the most notable aspects of the PPM capability development at the six case organisations is the constant investments they are making to monitor, analyse and improve

the process. The PPM capabilities clearly have a central role in each organisation's ability to dynamically adjust its resource allocation and project activities to meet ever changing environmental demands and organisational capability evolution. Each of the organisations has experienced a relatively recent increase in the importance of their PPM methods. This highlights the fact that in today's increasingly dynamic competitive environment the ability to dynamically adjust organisational activities and to ensure that projects are aligned with strategy is more important than ever. In addition, all of the case organisations have project management processes in place that are relatively robust and established. The existence of solid project management foundations forms an important aspect of organisational readiness for PPM in each of the case organisations.

The case study organisations represent a range of maturity levels related to the establishment of PPM capabilities. For example one of the organisations studied has deliberately established a new organisation-wide PPM capability over the last two years while in other organisations the PPM process has evolved more organically over ten or more years. The establishment or development of project management capabilities has preceded the development of the PPM capability in each of the organisations. Some of the organisations specifically invested in their project management capability in order to prepare for the development of the PPM capabilities. All of the organisations acknowledged that an effective and established project management capability was a pre-condition for a PPM capability.

Alignment with strategy is very important in the case study organisations and their PPM capabilities are believed to be very effective in achieving this alignment. Therefore it is likely that the learning investments directed to the establishment and evolution of the PPM capability in these case organisations are relatively effective.

The PPM capability is also believed to be responsible for creating balance in the portfolio and providing the oversight necessary to ensure resources are adequate for the project portfolio. Although performance in these areas is mixed among the case study organisations, they feel that continued investments in developing the PPM capability will improve performance. For example, during the evolution of their PPM process, several of the case organisations have shown a tendency to fall into the 'success trap' (Levinthal and March, 1993) where experience accumulation adjustments lead to short term projects being favoured over longer term opportunities, creating an imbalance in the project portfolio. In these cases the organisations have embarked on deliberate and explicit knowledge articulation and codification activities in order to correct the imbalance.

Evidence of knowledge codification is found within all of the case organisations, but not at the level of computer optimisation or decision support systems as proposed by many authors (for example see Ghasemzadeh and Archer, 2000, Gustafsson and Salo, 2005, Stummer and Heidenberger, 2003). This confirms previous findings on adopted PPM practices (Cooper et al., 2001, Killen et al., 2008). In practice the case study organisations use more 'management friendly' methods including formal project proposal and business case development processes, defined project management processes with documented decision point or 'gate' criteria, and standardised portfolio map and roadmap displays to facilitate group decision making .

Hypothesis testing

This case study research project indicates that the learning investments for the development of PPM capabilities are providing a return on those investments. In particular, innovation success at the case organisations is believed to be enhanced by the PPM capability's ability to

link projects to strategy. In addition continued investments are planned to further improve PPM capabilities in the case organisations.

Analysis of the development of PPM capabilities in these organisations provides an overview of the learning investments that have been used in the establishment and evolution of an effective PPM capability for each organisation. Both tacit and explicit learning mechanisms have been observed to develop the PPM capabilities in the case organisations. Table 2 summarises the main types of learning investments that have been applied in the case organisations to enhance the three types of learning mechanisms identified by Zollo and Winter (2002): tacit experience accumulation, explicit knowledge articulation, and explicit knowledge codification.

Table 2: Summary of main learning investments applied to enhance the three types of learning mechanisms in the case study organisations.

	Tacit Experience Accumulation
T1	Change of organisational structure that creates or elevates the locus for PPM activities.
T2	Determining the composition of the portfolio review board or team.
T3	Creation of environment that encourages the retainment of employees as longer serving employees can better accumulate and learn from experiences
T4	Hiring employees or engaging consultants with desired experiences and attributes
	Explicit Knowledge Articulation
A1	Schedule meetings and workshops for review and discussion and improvement of the PPM processes
A2	Engage consultants and facilitators to develop and manage information development and sharing sessions.
A3	Schedule regular reviews of project outcomes, evaluate and incorporate feedback to improve the process
A4	Use idea capture systems for input as well as comment, discussion and development or improvement of ideas.
A5	Conduct training programs for employees on the processes for project management and PPM
	Explicit Knowledge Codification
C1	Documentation of processes, creation of flow charts, templates, checklists.
C2	Development of idea capture system or database
C3	Development of web-based systems or computer applications
C4	Creation of spreadsheet based data formats to compare project information.
C5	Creation of standard graphical displays such as portfolio maps
C6	Develop formats for reporting on PPM status and outcomes

Table 3 presents a summary of the case study findings. The strength of emphasis on the ‘establishment’ and ‘evolution’ of the PPM processes at the six organisations has been evaluated based on the level of change and the types of recent and current activities. For example, Organisation A has put a large amount of effort into the introduction of an entirely new PPM capability to their organisation over the past two years – therefore the strength of emphasis on PPM establishment has been rated as ‘strong’. Organisation A has also been actively reviewing and evolving their process as it is being established, and is making a continual stream of iterative changes – therefore the evolution strength has also been rated as ‘strong’. In another example, Organisation D’s PPM capability has been slowly evolving for several years. The process is not newly established and there have been no major initiatives or large-scale changes to the process recently, so the strength of emphasis on PPM establishment is rated at ‘low’. The emphasis on the ongoing evolution of Organisation D’s PPM capability is rated as ‘mid’ based on a moderate level of emphasis on evaluating and adjusting the process.

Relative ratings are presented in Table 3 to indicate the level of each type of learning investment at each organisation. The ratings represent the sum of scores of between zero to

three for each of the activities in each learning mechanism that are identified in Table 2. A maximum of three points is awarded for evidence of strong effort and emphasis on an activity. Two points are awarded for moderate levels of effort or emphasis, one point for some mention of the activity and zero points are awarded if the activity was not evident at the organisation. The ratings are a rough measure only and are meant to highlight differences between organisations. They should not be used for fine-grained analysis.

The following two examples illustrate how the scores are derived from the case study findings. The first example focuses on the tacit experience accumulation learning activities or investments for T2, 'determining the composition of the portfolio review board or team'. T2 is rated at level three (3 = high) for Organisation A and level one (1 = low) for Organisation D. All of the organisations studied have a review board of some type with some method or criteria for membership in the review board. Organisation A has put a lot of effort into developing processes for the selection of the portfolio review board and into the actual selection of the review board. The board is carefully selected to represent all of the main functional as well as geographical areas. The processes for nomination, selection and confirmation of the review board members also include the length of tenure and processes for replacement and renewal of the review board. Careful attention is paid to phasing replacements to ensure adequate continuity for effective functioning of the review board. Organisation A's strong efforts in this area are rated at three (3), the highest level. In contrast, Organisation D's portfolio review board consists primarily of the regional marketing managers. There is not a lot of thought or effort put into the selection of the members of the review board which is heavily dominated by the marketing discipline. Therefore, Organisation D's relatively lower efforts and results in this area are rated at one (1).

To further illustrate the derivation of scores based on the case study findings, the second example focuses on findings for the explicit knowledge codification learning investment, C5, 'the creation of standard graphical displays or portfolio maps'. Organisation F is investing considerable effort to develop a comprehensive reporting format involving a series of graphical displays. These include portfolio matrix displays, colour coded resource pipeline planning projections and traffic signal colour-coded visual summary formats. Organisation C does not specify any type of portfolio map or graphical display in their formal PPM process. Sometimes such displays are used in particular submissions, but they have not invested in developing standardised graphical displays as part of the codified process. Therefore, C5 is rated at level three (3 = high) for Organisation F and level one (1 = low) for Organisation C. In this manner scores are allocated to each organisation for each type of learning investment identified.

The relative levels of learning investments presented in Table 3 represent a sum of the scores for learning activities or investments within each of the three main learning mechanisms. For example, the rating for 'learning investments for explicit knowledge codification' for Organisation C represents the sum of scores for each of the explicit knowledge codification items identified in Table 2. For Organisation C, the activity for C1 (Documentation of processes, creation of flow charts, templates, checklists) is rated at 3 (high), C2 (Development of idea capture system or database) is rated at 0 (none), C3 (Development of web-based systems or computer applications) is rated at 2 (medium), C4 (Creation of spreadsheet based data formats to compare project information) is rated at 3 (high) and C5 (Creation of standard graphical displays such as portfolio maps) is rated at 1 (low, as explained above), and C6 (Develop formats for reporting on PPM status and outcomes) is rated at 2 (medium). Therefore the total of the ratings for C1-C6 (3+0+2+3+1+2) has been

entered as the relative level of '11' in Table 3 for 'learning investments for explicit knowledge codification' for Organisation C. In this way, each of the ratings entered in Table 3 indicates the overall relative level of investment in learning activities for each of the learning mechanisms.

Table 3: Relative levels of learning investments during PPM capability development

Organisation code	A	B	C	D	E	F
Strength of emphasis on PPM Establishment	STRONG	MID	LOW	LOW	MID	STRONG
Strength of emphasis on PPM Evolution	STRONG	STRONG	MID	MID	STRONG	STRONG
Learning investments for tacit experience accumulation	11	7	6	7	7	11
Learning investments for explicit knowledge articulation	13	11	11	12	11	12
Learning investments for explicit knowledge codification	18	14	11	11	10	16

Table 3 shows that all of the case organisations invest regularly in each of the learning mechanisms indicating that PPM capabilities are shaped by the co-evolution of both tacit and explicit learning mechanisms as proposed by Zollo and Winter (2002). Each of the organisations studied has a successful project portfolio and believes that their PPM capability contributes to this success, therefore the PPM capabilities are considered effective.

The level of investment in knowledge articulation activities does not vary much across the case organisations and is independent of the strength of emphasis on establishment or evolution. This finding supports hypothesis H2, and indicates that knowledge articulation investments may assist with the development of effective PPM capabilities in a relatively consistent manner throughout the establishment and evolution of PPM capabilities.

The two organisations that have the strongest level of emphasis on PPM capability establishment (Organisations A and F) also make much higher levels of investment in tacit experience accumulation and knowledge codification activities than the organisations that have lower levels of emphasis on establishment. These findings provide some initial support for hypotheses H1 and H3, and indicate that the level of investment in tacit experience accumulation (H1) and explicit knowledge codification (H3) learning mechanisms required for effective development of a PPM capability varies relative to the level of emphasis on establishment of the capability.

Conclusion

PPM capabilities are a dynamic capability and a source of competitive advantage. As a dynamic capability, PPM capabilities must evolve and adapt through learning processes to remain relevant in changing environments. Case studies of successful organisations in diverse industries reveal that both tacit and explicit learning mechanisms shape the establishment and evolution of PPM capabilities. Learning investments applied in these organisations reflect the

importance placed on the PPM processes and the expectation of a return on the investment. The case studies indicate that the organisations believe they are receiving a return on their investments in organisational learning activities through enhanced alignment of projects with strategy and sustainable innovation success.

The findings from this project will assist managers to select the most effective areas to focus learning investments in order to improve organisational performance. The research suggests that managers can enhance and sustain competitive advantage by investing in tacit experience accumulation, explicit knowledge articulation and explicit knowledge codification learning mechanisms to develop their PPM capability. Hypotheses have been put forward that relate the area of emphasis for PPM capability development to the appropriate strength of investment in the three types of organisational learning mechanisms. The case study findings lend support to the hypotheses, and indicate that although all three learning mechanisms are important throughout the establishment and evolution of PPM capability development, the development of an effective PPM capability will require particularly strong investments in enhancing tacit experience accumulation mechanisms and explicit knowledge codification mechanisms during the initial establishment or during periods of radical change to the PPM process.

Limitations and further research

Academics interested in the relationships between deliberate learning investments and the development of dynamic capabilities as well as managers who need to make decisions about organisational learning investments for the development of dynamic capabilities like PPM capabilities will benefit from the findings presented in this paper. However, while these findings are consistent across six organisations that were chosen to represent a diverse set of industries, further research is required to determine whether the findings are generalisable across other organisations and industries. In addition, the limitations of the research methodology as discussed earlier needs to be taken into consideration. Therefore these results will require validation by further studies. For example, a survey of a larger sample of organisations could be used to test the hypotheses, or a longitudinal study could be used to capture in-depth information about learning investments and the evolution of the PPM capability over time.

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