Inclusion of strategic management theories to project management

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Abstract

Purpose – The purpose of this paper is to explore the benefits of integrating the theory of constraints (TOC), resources-based theory (RBT), resource advantage theory (RAT), with a structured project-based methodology e.g., Project Management Body of Knowledge. This paper describes each theory and explores what benefits a unified model would bring to project management. This paper represents the conceptual development of an integrated framework that will be tested in a range of project management scenarios in various industrial sectors.

Design/methodology/approach – Extant literature is used to develop a conceptual framework of an integrated model that will be tested in the field for robustness. The model has been applied to published projects to identify its strengths and weaknesses.

Findings – The work shows important implications for improved success of projects from the use of TOC, RAT and resource dependence theory (RDT). Specifically, it emphasizes the need for application of strategic theories to project management.

Research limitations/implications – While TOC, RAT and RDT are well established in the context of organization theory, there is limited application in project management. Moreover, the model has yet to be applied in the field. The hypotheses identified in this research are currently being tested using field-based surveys.

Practical implications – The research falls short in addressing some resources, e.g. innovation, tacit knowledge and decision making methods in traditional project management context. Therefore, identifying these critical resources in future work and exploiting them as the means of improving project performance would enhance the success of project-based management.

Social implications – Project management is an emergent discipline and a project is temporary in nature. Therefore, new ideas and development of theories for project management practices are required. This innovative research, for example, may change the way projects are executed in future.

Originality/value – This paper examines the components of a successful project according to the iron triangle, i.e. scope, quality, time and cost. However, through the application of TOC, RAT and RDT into an integrated project-based management framework gives new insights to resources management.

Keywords Theory of constraints, Resource advantage theory, Resource-based view, Resource dependence theory

Paper type Conceptual paper

Introduction

The problem of resource allocation across a portfolio of projects in a dynamic environment where there is competition amongst other internal projects, has been acknowledged in the project management literature (Collyer and Warren, 2009). To minimize this problem, organizations attempt to manage the resource requirement according to the level of priority attached to the project (Engwall and Jerbrant, 2003). In managing resources, the organization must evaluate the value of a particular set of resource capabilities based on the market context within which a firm is operating.

Project management is a relatively young discipline in terms of our understanding through research; hence there are numerous potential methodologies that could be applied to improve the possibility of project success (Killen *et al.*, 2012). Equally,

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the notion of project success is open to interpretation (Shenhar *et al.*, 1997, 2000, 2001; Shenhar, 2001).

Alternatively, organizations could aim to enhance their autonomy in resource availability and ownership and maintain resources stability to reduce uncertainty (Davis and Cobb, 2010). Clearly, managing uncertainty is a key issue for project success (Rand, 2000). If the organization can effectively manage resource scarcity, availability and control, it reduces uncertainty in the dynamic environment. Vigilant management of resources can result in competitive advantages for projects; which allow organizations to create more value than rivals and achieve superior returns on investment in projects (Barney and Hesterly, 2008).

There is clear evidence that the poor success rate of projects is due in-part to poorly managed resources and recognition of constraints (Lim and Mohamed, 1999). There is a need for this combined theoretical framework to better plan and manage projects.

This paper explores the relationship between resource scarcity, resource dependency and the constraints that these phenomena place upon successful project outcomes. It progresses by first discussing theory of constraints (TOC), resource-based view (RBV), resources advantage theory (RAT), resource dependence theory (RDT) and conventional structured project management techniques. A conceptual framework of the combined theories is then described; that allows a number of propositions to be identified. Next, an integrated, unified framework is developed that allows exploratory testing against several project cases. Finally, conclusions, limitations and future research are identified.

Objectives of project management

A key role of the project leadership is managing the trade-off between scope, schedule and cost . Traditionally, project success has been measured based on "the triple constraints" or "the iron triangle" of time, cost and scope objectives (with quality sometimes displayed in the centre of the triangle) (Sebaux *et al.*, 2011; Müller and Jugdev, 2012). These elements are mutually dependent; therefore, a change in one will have a resultant effect on at least one other element. Incorporating strategic management theories in project management underpins the view that success goes beyond the "iron triangle" (see e.g. Ika, 2009; Shenhar *et al.*, 1997, 2001; Shenhar and Dvir, 2007). Leverage opportunities, social development, and technological improvements resulting from the project are also successes.

The availability of resources in project delivery can be a key driver of schedule or cost overruns; with one survey concluding that 46 per cent Middle Eastern capital and infrastructure projects had suffered significant delays, and only 36 per cent of projects came in at or below budget. Organizational capability was found to be a key concern for 47 per cent of organizations, and more than 50 per cent of projects were impacted by fundraising difficulties . While PwC's suggested remedy was improved project reporting that focused on identifying issues early, the results suggest that resource constraints are having a significant impact upon the successful delivery of projects; and therefore further investigation of the impact of resource constraints upon the process of project management would be beneficial.

Surveys indicate 42 per cent of engineering projects and 81 per cent of oil and gas projects are behind schedule (Chartered Institute of Building, as cited in Parker *et al.*, 2012), and only 32 per cent of Information and Communication Technology (ICT) projects are successful (Standish Group CHAOS report, 2009 as cited in Parker *et al.*, 2013). Shenhar and Dvir (2007) conducted a study of more than 600 projects in the

business, government and not-for-profit sectors across various countries. The findings were that some 85 per cent of projects failed to meet time and budget goals.

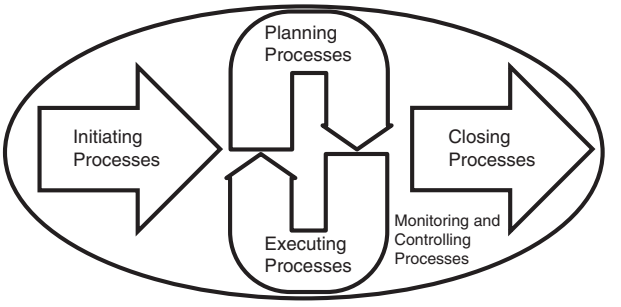
One may deduce that project failure could be caused by poor planning, insufficient resources or lack of communication (Ika, 2009). However, Shenhar and Dvir (2007) argue that the evidence suggests failure is often found even in well-managed projects run by experienced project managers and supported by highly regarded organizations. Similarly, Sauer *et al.* (2001) note that a central aspect of ICT's approach to project management is their disciplined application of tools and techniques which has been adopted so widely and rigorously, to the point where some leading experts perceive the IT industry as sophisticated in project management.

The Project Management Body of Knowledge (PMBOK) (PMI, 2013) identifies project management activities into five key project management process groups (see Figure 1). These five elements are Initiating processes, Planning processes, Executing processes, Monitoring and Controlling processes and Closing processes (PMI, 2013). Managing these processes and their inputs is a core function of the Project Manager; and lies at the heart of the project management skillset. In contrast, the management of resources and the firm's relationship with the environment is at the core of the skillset of strategic managers . We argue that project managers may be better equipped if they had greater applied knowledge of a range of strategic and operational frameworks.

A key question in project management literature is how to measure project success (Wateridge, as cited in Choi *et al.*, 2011). Pinto and Slevin (as cited in Müller and Jugdev, 2012, p. 758) noted: "There are few topics in the field of project management that are so frequently discussed and yet so rarely agreed upon as that of the notion of project success".

More recently, authors have begun to criticize the traditional approach to project management, arguing that this approach stresses predictability, which in turn places an overemphasis on planning, design and development, and is ineffective for managing projects which entail high levels of complexity and uncertainty (Shenhar and Dvir, 2007; Sebaux *et al.*, 2011; Kapsali, 2013). Upon reflection of the often heard proposal for more and better project management tools, techniques and discipline, Sauer *et al.* (2001, p. 40) argue that "it seems unlikely that 'more of the same' will yield a significant improvement in performance."

Shenhar and Dvir (2007) proffer that most project problems are not technical but managerial, and stem from the framework and the mind-set that drive the traditional approach, rather than from a lack of processes and practices. We argue, as do Choi *et al.*



Source: PMI (2013)

Figure 1.
The five key project management process groups

(2011), that traditional success measures of time, quality and cost, do not always reflect stakeholders' expectations of a project's purpose – in fact, numerous examples exist of projects now recognized as successful but on completion had failed on one or more of the three criteria.

This paper examines three popular management theories and discusses how each theory can be integrated into project management to improve the likelihood of project success.

RBV/resource advantage theory (RAT)

Barney's (1991) RAT explains differences in performance between organizations as being the result of the unique combination of resources possessed by each organization. The theory is a subset of the broader RBV of the firm literature. RBV has developed to become one of the key paradigms used within strategic management research to explain the source of sustained advantage over competitors (Barney, 2001a; Das and Teng, 2000; Kraaijenbrink *et al.*, 2010). Prior (2003, p. 2) provides a definition, stating, "The RBV focuses on the use and deployment of resources […], the development of resource-based core competencies and the eventual competitive advantage that results from this process."

The RBV framework is commonly adopted to explain how organizations (or project teams) can develop and sustain a competitive advantage through the application of the heterogeneous resource base. There are differences in the literature with regard to which resource characteristics are considered relevant. However, in summary, resources are a source competitive advantage if they are valuable, scarce (rare), inimitable, non-substitutable, durable, appropriate and organizational focused (Grant, 1991; Barney, 2001a, b; Jugdev, 2004; Jugdev and Mathur, 2013). Barney's (2001b) VRIO (valuable, rare, inimitable, organizational focused) framework appears to be the most commonly adopted and used in empirical studies (Jugdev, 2004; Jugdev and Mathur, 2013).

Strategic assets are often referred to as "core competencies" (Prahad and Hamel, 1990), "organizational capabilities" (Grant, 1991) or "dynamic capabilities" (Nemati *et al.*, 2010). Clearly, strategic assets involve complex patterns of interaction and coordination between resources (including capital assets and people), processes and knowledge, in order to effectively transform inputs into outputs (Grant, 1991; Prior, 2003; Jugdev, 2004). Jugdev (2004) highlights that strategic assets are more important than individual resources, however, resources are essential in developing strategic assets. Jugdev (2004, p. 19) also highlights the link between strategic assets and competitive advantage, stating:

> Strategic assets involve a mix of explicit and tacit knowledge that is embedded in a company's unique internal skills, knowledge, and resources (Foss, 1997; Rumelt *et al.*, 1994). Such strengths are difficult to purchase, let alone copy, so they can contribute to a firm's ability to move beyond competitive convergence toward a competitive advantage or strategic position.

Jugdev and Mathur (2013) argue that intangible, knowledge-based resources are more likely to serve as sources of competitive advantage because they allow firms to incorporate practices into their processes that are valuable, rare, inimitable and organizational focused. Knowledge-based resources are especially difficult to imitate due to causal ambiguity, social complexity and associated organization-specificity (Teece, 1998 as cited in Jugdev and Mathur, 2013).

The RBV perspective also discusses how organizations should assess their resources and strategic assets, and determine which should be developed and which should be de-emphasized (Grant, 1991; Prior, 2003; Jugdev, 2004). Grant (1991, p. 131) states:

> A resource-based approach to strategy is concerned not only with the deployment of existing resources, but also with the development of the firm's resource base. This includes replacement investment to maintain the firm's stock of resources and to augment resources in order to buttress and extend positions of competitive advantage as well as broaden the firm's strategic opportunity set […] Sustaining advantage in the face of competition and evolving requirements also requires that firms constantly develop their resources bases.

RAT posits that the majority of an organization's resources are homogenous and mobile and can therefore be relatively easily obtained or duplicated by an organization's competitors, and therefore do not provide an advantage when competing against industry peers (Wernerfelt, 1984). However, a sustained competitive advantage is obtained when an organization possesses resources that are heterogeneous and immobile (Barney, 1991). A resource's heterogeneity and immobility is determined by its value, rarity, inimitability and non-substitutability (VRIN) (Barney, 1991). Its potential to deliver a sustainable competitive advantage to the organization is moderated by whether the firm is organized to exploit the advantage offered by ownership of the resource (VRIO) (Barney and Hesterly, 2008).

Potential applications of RBV/RAT research in the field of project management have previously been discussed by Killen *et al.* (2012), however their review was primarily focused upon project management capability as a source of competitive advantage. To-date, there has been limited discussion of the potential applications of RAT in aiding understanding of the drivers behind project success and failure in environments where projects are competing against each other for critical resources. We wish to explore whether the application of RBV, and in particular, RAT in a project-based context is a fruitful line of enquiry.

A project team is a temporary group of individuals requiring various resources; in effect a temporary organization within the wider organization (PMI, 2013). The unique combination of resources available to this temporary organization can be a source of competitive advantage or disadvantage for a project's successful completion (Barney, 2001a, b). Accordingly, the success of a project is at least partially dependent upon the project team having access to key resources that provide a competitive advantage over other projects within the organization, and more broadly across industry and market. Therefore the key concept underpinning RAT is the scarcity of resources in the external environment and their impact upon a project's completion.

RDT

Pfeffer and Salancik's (2003) RDT explains interactions between organizations' attempts to reduce reliance upon the external environment for resources e.g., sub-contractors, while simultaneously increasing the reliance of other organization's on their own resources e.g., project skills. Control of vital resources is considered to be the source of power in inter-organization/stakeholder relationships, allowing the controller of vital resources to impose economic considerations upon other organizations which are reliant upon access to the resource (Ulrich and Barney, 1984). RDT research has traditionally focused upon the five key strategies that

organizations use to obtain vital resources from other organizations and mitigate environmental constraints: mergers, joint ventures (JVs) and other inter-organizational relationships, boards of directors, political action and executive succession (Hillman *et al.*, 2009; Pfeffer and Salancik, 2003).

Project management research, as a body of work, has been criticized for its focus on the internal dynamics of projects as the key contributors to the success of a project (Soderlund, 2004). Few studies have focused upon the environmental context and the relative impact upon project outcome (Engwall, 2003). Given the potential importance of key resources as a source of competitive advantage for projects within an intra-organization and inter-organization environment, RDT may be a useful tool for exploring the nature and methods of competition and collaboration between projects in the context of an environment of scarcity. The fundamental underpinning concept of RDT is control of key resource and the political and commercial benefits that this confers upon organizations that have control, and the political and commercial disadvantages conferred upon those that are dependent upon others in the external environment for access to key resources.

RDT is used to explain how organizations reduce environmental interdependence and uncertainty (Hillman *et al.*, 2009). Drawing from organizational theory, RDT characterizes the organization (or project organization) as an open system; and is based on the premise that all organizations are not autonomous and are constrained by critical dependencies on other organizations for the provision of vital resources (Drees and Heugens, 2013).

Under RDT, resources are a perceived as a basis of power, therefore, power and resource dependence are directly linked. Davis and Cobb (2010, p. 24) note that exchange-based power in RDT was derived from Emerson's (1962) parsimonious account:

> […]. the power of A over B comes from control of resources that B values and that are not available elsewhere. In this account, power and dependence are simply the obverse of each other: B is dependent on A to the degree that A has power over B. Further, power is not zero-sum, as A and B can each have power over each other, making them interdependent.

RDT is based on the premise that organizations seek to manage their environments and reduce their dependencies, uncertainties, and other's power over them by engaging in inter-organizational relations (Hillman *et al.*, 2009; Davis and Cobb, 2010; Drees and Heugens, 2013). Pfeffer and Salancik (as cited in Hillman *et al.*, 2009, p. 1405) note that organizations inevitably never manage all external interdependencies, and any actions produce new patterns of dependence and interdependence, which in turn produce inter-organizational as well as intra-organizational power, where such power has some effect on organizational behaviour.

Davis and Cobb (2010, p. 23) identify three core ideas of the RDT framework: first, social context matters; second, organizations have strategies to enhance their autonomy and pursue interests; and third, power (not just rationality or efficiency) is important for understanding internal and external actions of organizations.

Pfeffer and Salancik (as cited in Hillman *et al.*, 2009, p. 1405) suggest the following five actions that can minimize environmental dependencies: first, mergers/vertical integration; second, JVs and other inter-organizational relationships; third, boards of directors; fourth, political action and fifth, executive succession. Organizations engage in inter-organizational arrangements to cope with interdependencies, strengthen their

legitimacy and restore some degree of control (autonomy) over their environments (Davis and Cobb, 2010; Drees and Heugens, 2013). According to Santos and Eisenhardt (as cited in Drees and Heugens, 2013, p. 64), "[…] implementing such arrangements enables organizations to set their boundaries 'at the point that maximizes strategic control over crucial external forces'".

There is much empirical research supporting the rationale that resource dependencies are an antecedent to mergers, alliances, JVs and board interlocks (Hillman *et al.*, 2009). Hambrick, Finkelstein, Cho, and Jackson (as cited in Hillman *et al.*, 2009) note that recent research suggests that from the period between 1980 and 2000, firms engaged in resource-dependency relationships to reduce their overall environmental dependency.

TOC

The TOC is primarily concerned with managing uncertainty to minimize resource constraints for multiple projects. The TOC can be used to evaluate obstacles, limitations and similar problems in a project and develop a breakthrough solution (Rand, 2000). The TOC is used for developing resources' timelines, for example resource's availability allows project scheduling, to the extent that activities using identical resources are scheduled in series (Steyn, 2002). Leach (2010) argues that more detailed planning or more sophisticated computer programs cannot correct the constraint-based problems (over time, within budget and under-scope). It can be argued that project reality has dynamic variation due to uncertain estimates, dependent events and often scarce resources. Therefore, the organization should focus on project timelines and identify the core constraint that prevents the project execution from performing better rather than breaking the process down and improving the efficiency of each step (Bevilacqua *et al.*, 2009).

TOC incorporates a sequence of progressive steps for improving the current situation. The objective is to identify the weakest link in the project management plan (this being regarded as a constraint), exploit the constraint, subordinate all else to the strategy to manage the constraint, elevate the constraint, and if previous steps fail, go back to step one (Rand, 2000). Application of TOC needs, "supportive organization policy and resource availability to enhance the project timelines" (Leach, 2010, p. 62).

According to Styen (2002), the TOC time management technique (sometimes referred to as critical chain scheduling (CCS)) has been extended to allocate resources to project-based organizations that share common resources. This maximizes the number of projects in the organization while maintaining the principles for reducing durations' of individual projects. It is also argued that TOC should be applied initially for project time management, although it also can be used for project risk assessment and cost management. Moreover, Styen (2002) also argues that project timelines are a major constraint in project execution because of the need for positive cash flow, reducing contingency costs of delays and need for scope changes. Therefore the two key underlying features in using TOC are the availability of key resources, and the ability of organizations to mobilize these resources in a timely manner to meet project schedules and maximize resource utilization.

TOC is based on the argument that any manageable process, such as a project, is restricted from achieving its scope by at least one constraint (Rand, 2000; Tulasi *et al.*, 2012). A five step approach is undertaken to review processes, identify constraints, improve the capacity of the constraint and restructure the rest of the organization

(project) around it (Tulasi *et al.*, 2012). This process (as cited in Rand, 2000, p. 174) includes:

(1) identify the constraints(s);

(2) decide how to exploit the constraint(s);

(3) subordinate everything else to the above decision;

(4) elevate the constraint(s); and

(5) if, in the previous steps, a constraint has been removed, go back to Step 1, and do not allow inertia to cause a process constraint.

Rand (2000, p. 174) notes:

> The difference between Step 2 and Step 4 relates to the amount of investment required, whether in terms of time, effort, money, or willingness. The difference is sometimes pithily expressed as "whatever we can do tomorrow is Step 2".

The application of Step 4 may have altered the process constraint, resulting in the previous constraint being removed and a new constraint emerging. Therefore, Step 5 involves reviewing the modified process to identify new constraints/bottlenecks. The TOC approach is therefore a process of continual improvement (Rand, 2000).

Goldratt (1997) applies the TOC to project scheduling – referred to as "CCS", to reduce project duration and simplify project control. According to Rand (2000, p. 174), the critical chain was developed because of "the existence of chronic problems that existing methods, approaches and even expensive software have not been able to remove". The key elements of CCS are to focus on critical areas (i.e. critical activities and resources); avoidance of task due dates, milestones and multitasking; and insertion of various buffers at strategic points in the project schedule (Rand, 2000; Herroelen and Leus, 2001; Steyn, 2002; Millhiser and Szmerekovsky, 2012).

Whilst not discussed in further detail in this paper, Herroelen and Leus (2001, p. 560) consider CCS to be an effective project management strategy which can be deployed to avoid project delays caused by Parkinson's Law (an adage which states work expands to fill the time available for its completion), whilst protecting for Murphy's Law (i.e. uncertainty involved in the work). These views are also supported by Steyn (2002) and Rand (2000) who highlight that safety reserves are often overestimated in traditional project management approaches, which results in a tendency for project team members to procrastinate. Whilst empirical studies are lacking, authors' continue to cite examples of numerous case studies of successful project execution where CCS is applied, ranging from private, public and government sectors (Rand, 2000; Millhiser and Szmerekovsky, 2012; Tulasi and Rao, 2012). Benefits cited include substantial time savings, profitability, customer satisfaction, and worker enthusiasm (Millhiser and Szmerekovsky, 2012).

A further valuable insight into the use of TOC in the execution of projects was that derived from the work of Mabin and Balderstone (1998, 2003) who investigated more than 100 extant cases of companies which had applied TOC concepts. The concluding information was that, typically, the duration of the project was shortened by an amazing 60 per cent from the time originally estimated.

Discussion of applicability of the theories

Constraints exist in all stages of a project and include time, cost (budget), scope and quality, as well as other factors such as risks and resource availability. Therefore,

the application of the TOC to project management is important, as management of key constraints can result in reduced delays, and therefore increase the likelihood of delivering the project on-time, within budget and to scope and quality specifications.

To ensure project success, project managers need to be continually on the lookout for critical constraints and identify opportunities where constraints can be removed or mitigated. As noted previously, it is the projects which entail high levels of complexity and uncertainty, where traditional project management techniques have been found lacking, and are therefore more susceptible to failure (Kapsali, 2013). Project managers should therefore identify and manage constraints in all phases of the project and aim to reduce the levels of complexity and uncertainty, in order to minimize the potential for delays, cost blow outs, scope creep and poor quality. As noted by Tulasi and Rao (2012, p. 334) "The secret to success lies in managing these constraints and the system as it interacts with these constraints, to get the best out of the whole system." Parker *et al.*, (2012. p. 210) adds to this, suggesting that removal of the key constraints "frees up substantial capacity and removes wasteful costs."

This paper has previously discussed how the TOC methodology has been applied to project scheduling (CCS) to reduce potential delays. Similarly, Turner (as cited in Steyn 2002, p. 78) argues that the TOC methodology can also be applied to project cost management, recognizing that work packages (like task durations) encompass cost contingencies to manage uncertainty, and should therefore be aggregated to the project level which results in a significant reduction in total project costs. This view is supported by Steyn (2002, p. 79) citing that he "doubts that there could be any fundamental reason why earned value analysis should be incompatible with TOC."

The TOC methodology can also be applied throughout the five project processes, as outlined in the PMBOK Guide (PMI, 2013) to augment appraisal of constraint implications for each of the processes. For example, as part of the initiation process, project managers can minimize uncertainty and risks by defining specific project objectives (including the iron triangle objectives), managing key stakeholders' expectations, and developing strong communication ties with the client to identify potential, foreseeable risks. In the planning phase, project managers can minimize uncertainty and risk by employing methods/strategies which have been successful in the past, using products/materials which have been "tried and tested" and utilizing sub-contractors when resources are constrained. In the monitoring and controlling phase, progress and performance can be measured against key performance indicators for time, cost, scope and quality objectives. The Monitoring and Controlling processes occur at the same time as other process groups, and is therefore depicted as a "background" process group in the PMBOK Guide (PMI, 2013). The TOC methodology is a process of continual improvement, therefore, it complements this process as it encourages project managers to identify constraints at each stage of the project and implement measures to address these constraints. Finally, during the closing process, a final review of the project and documentation of "lessons learned" is conducted, which can include an overall assessment of how constraints were managed throughout the project life cycle.

The RBV perspective is also important to project management, as it focuses on the use and deployment of a firm's resources and development of strategic assets for achieving a competitive advantage. In the RBV, resources may be classified as tangible, intangible or strategic assets (Collis & Montgomery, as cited in Prior, 2003).

Project management often requires application of structured and unstructured approaches involving a combination of processes that encompasses tools, techniques,

methodologies, and best practices. Tangible resources include common project management tools, techniques, standards and practices; whilst intangible resources can include invisible assets, tacit knowledge and unique capabilities, routines and processes (Jugdev, 2004; Jugdev and Mathur, 2013).

As previously discussed, project success is not always achieved by simply applying traditional tools and techniques that are recognized as best practices. Shenhar and Dvir (2007) argue that the traditional approach is based on a predictable, fixed, certain and relatively simple model, however, most projects today are uncertain, complex and changing, and are strongly affected by the dynamics of the external environment. Therefore, project managers need to possess additional skills and competencies to be capable of successfully managing most modern day projects.

The PMBOK Guide (PMI, 2013, p. 17) states that in addition to any area-specific skills and general management proficiencies required for the project, effective project management requires that project managers possess competencies in project management knowledge, performance and personal skills. Further, effective project managers also require a balance of ethical, interpersonal and conceptual skills to help them analyse situations, interact appropriately and guide the project team, whilst simultaneously achieving project objectives and balancing project constraints (PMI, 2013). These views are also supported by Sauer *et al.* (2001) who state effective project managers require crucial competencies in planning, controlling, communicating, negotiating, problem-solving and leading, and combine these requisite skills with personal characteristics including experience, commitment and the need to achieve.

There is growing empirical evidence which suggests project success is directly linked to the amount of autonomy and authority project managers have over their projects (Gray and Larson 2011). In some organizations, project outcomes may suffer due to internal competition for resources between project managers and operational managers, and competing organizational priorities. Therefore, an organization's project management capabilities also contribute directly to project success by providing a supportive context for project managers. According to Sauer *et al.* (2001, p. 41) organizational capability in project management is demonstrated through a complex combination of organizational arrangements and management practices including organizational structure, role design, reporting processes, methods and procedures, focus and values, contracting relationships and human resource management. To ensure project success, Sauer *et al.* (2001) argue that organizations need to establish relevant structures and processes to support its organizational project management capability, which in turn will create a self-reinforcing dynamic and increases organizational support for the conduct of projects.

Effective project managers provide the foundation for successful project outcomes as they are ultimately responsible for achieving the project objectives. Applying the RBV, organizations should focus on developing the skills of their project managers and other project team members, to ensure they possess the necessary skills and capabilities to successfully deliver projects. Furthermore, an organization's project management capability also plays an important role for project success, to provide a supportive context. Therefore, organizations need to develop their organizational project management capabilities to assist with project performance.

Finally, the RDT perspective is also important to project management as it focuses on how organizations (or project managers) can manage their external environment and reduce their dependencies and uncertainties. As previously discussed, every

project is susceptible to the triple constraints of time, cost and scope. Resource availability is also another common project constraint due to factors internal and external to the organization. In order to manage these constraints, organizations regularly employ strategic tactics such as JVs, alliances, outsourcing/subcontracting and other forms of inter-organizational relationships, which can provide additional resources and assist with meeting the iron triangle objectives and delivering a successful project. Furthermore, some organizations may not possess the necessary capabilities, or may be resource constrained due to other competing projects, and may therefore choose to subcontract certain elements (i.e. such as the design component or close-out process) to other organizations which specialize in these areas.

There are numerous factors to consider when deciding whether to engage in inter-organizational relationships and which firms to engage with. Application of the RDT perspective can therefore assist by providing a more strategic approach and helping decision makers to understand their respective project environments and which resources they are dependent on from external organizations.

Hillman *et al.* (2009, p. 1417) suggest that the RBV and RDT theories may complement each other given their focus on resources. Integration of these theories may provide new insights into organizational resource endowments, and explain how organizations can achieve a competitive advantage by obtaining VRIO resources from the external environment (Hillman *et al.*, 2009).

Furthermore, Hillman *et al.* (2009, p. 1417) note:

> Comparing these two theories allows consideration of both an internally focused perspective of how organizations specify resource needs and an externally focused perspective of how organizations obtain these valuable resources. A synthesized approach may offer insight into how obtaining control of critical resources offers firms competitive advantage and how developing resource interdependencies around critical resources affect the advantage derived from them.

Building on from this, the RBV/RAT and RDT theories can be integrated to assist decision makers in assessing the strengths and weaknesses of their resource-base and capabilities, and developing strategic relationships with other organizations which complement their strengths and weaknesses. Over time, these relationships may eventuate into long-term partnerships, from which firms can learn from each other and enhance their capabilities.

Therefore, TOC, RBV/RAT and RDT are important theories to project management as they provide insight into how project managers (and other key decision makers) can increase the likelihood of project success by managing project constraints, utilizing internal resources and strategic assets and reducing dependencies and uncertainties.

To-date, few studies in the project management literature have focussed on the role of the external environment in project success, with research being focused primarily on studying the internal dynamics of projects and how the five core project process groups may be improved to increase project performance . In contrast, the interaction between a firm and its external environment is a key research focus of the strategy literature. Figure 2 illustrates the important differences between the two literatures.

This paper is primarily focussed on synthesizing these two worldviews and applying the lessons learned from the strategic management literature to the study of project-based management (see Figure 3). The integration of these streams of literature will allow for a more comprehensive understanding of the key drivers of successful project outcomes that consider both the internal and external contexts in which

projects are executed. Exploring project management through a resource-based lens will enable development of strategies and tools to assist project managers in navigating and mitigating the constraints imposed by resource scarcity and the organizational interdependencies that result.

As an initial step in this direction, this paper will map the applicability of strategic management resource-based theories (RBT) to the five major project management process groups. Mapping the fundamental concepts of each theory to the process groups is the first step in the development of a framework that synthesizes the strategic management and project-based management literature.

As depicted in Figure 4 it is proposed that the fundamental underlying concept of the RBV/RAT, specifically scarcity of key resources and the advantages conferred upon

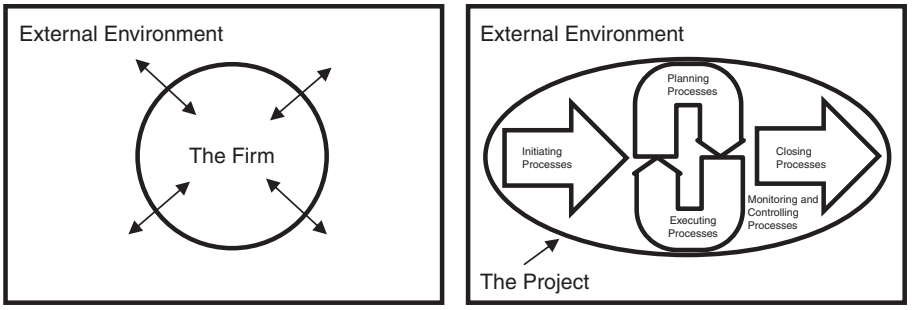


Figure 2.
Differences in research focus between strategic management and project management worldviews

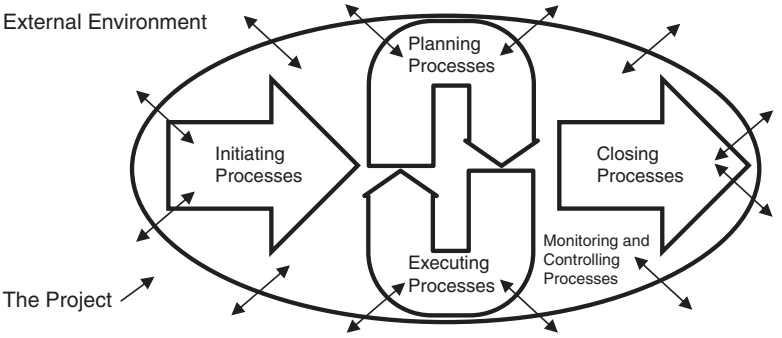


Figure 3.
The project interacting with the external environment – the integration of the strategic management and project management worldviews

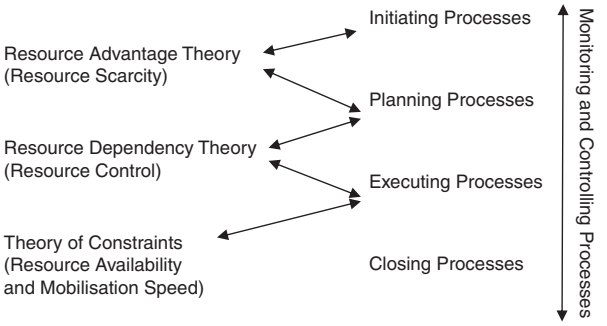


Figure 4.
Applicability of strategic management theories to five project management process groups

organizations which possess them, has a significant impact on projects during Initiating and Planning processes. Considerations of the scarcity of resources will help define the strategy behind the project, drive the scope setting of the project and inform assessments of project feasibility during the Initiating processes. During the Planning processes, the relative scarcity of resources required to execute the project should be a key consideration in development of the project's resource plan, procurement plan, risk plan and schedule.

The fundamental underlying concept of RDT, that the control of key resources and the political and commercial advantages that control allows, has a significant impact upon projects during the Planning and Executing processes. Consideration of the control of key resources is important during project Planning processes, as schedules, budgets, procurement plans and risk plans will need to be adjusted to allow for procurement of key resources that the project does not already control. Control of key resources will continue to be an important consideration for risk monitoring during Executing processes as other projects or organizations may seek to gain control of a project's key resources for their own projects. Accordingly, appropriate mitigation strategies need to be put in place to cover the potential loss of key resources during Execution processes and closing.

The two underlying perceived limitations in the TOC, resource availability and mobilisation speed of resources, have a significant impact upon projects during the Executing and Closing processes. First, if resources are not available for the project during the Executing processes then the project schedule will be impacted and mitigation strategies may need to be employed. Second, if resources are slow to mobilize during the Executing and Closing processes the project schedule will again be impacted and costs may need to be incurred in order to increase or mitigate the mobilization speed of key resources.

While the core concepts of the three theories, arguably, do not directly impact a project's Monitoring and Controlling processes, the risk plans and project reporting frameworks developed during the Planning processes should be informed by consideration of the impacts of resource scarcity, resource control, resource availability and mobilisation speed of key resources. Accordingly, close monitoring of the implications of these concepts will contribute to successful project outcomes. Furthermore, while none of the concepts typically might impact the Closing processes, they will affect the project outcome; and consequently, discussion of the way in which they impacted the project should form a key component of the lessons learned during the project.

Conceptual model

Planning, scheduling and mobilizing resources are key components of a project manager's role (PMI, 2013). However, project managers often face situations in which key resources for the project are partially or completely unavailable. This may be due to a range of factors, including allocation of the resource to other projects or activities, or the resource being temporarily absent from the organization or the organization not possessing the required resource to begin with. If a resource is unavailable a project manager may need to delay the project until available, request additional funding to procure the resource from outside the organization or adjust the project objectives to account for the lack of capability within the project (Rand, 2000). If a scarce resource is planned to be used in the project, then obtaining the resource may require negotiation with its owners – which can significantly impact a project manager's ability to deliver the project on-time, within budget or within scope (Engwall and Jerbrant, 2003).

We deduce that project managers can increase the likelihood of project success (as measured by the objectives of the "iron triangle"), by applying the TOC, RBV/RAT and RDT to manage project constraints, utilize valuable internal resources and strategic assets, and reduce dependencies by engaging in inter-organizational relationships with other organizations which complement their weaknesses. This can be applied during the initiation, planning and execution phases of a project. However, it should also be noted that the application of these theories is important at an organizational level, to improve an organization's project management capabilities.

Therefore, it is proposed that a proposition for testing is:

P1. When key project resources are scarce, is the availability of key project resources reduced?

Conversely, if an organization already possesses a key resource and does not need to compete for it in the external environment, then this will improve the likelihood that the resource will be available to be assigned to the project. Organizations can increase the likelihood of project success (as measured by the iron triangle objectives), by applying the TOC, RBV/RAT and RDT to manage internal and external factors which are constraining their projects, develop their organizational capabilities, develop their individual project managers' capabilities, and develop partnerships with other firms to strengthen their project management capabilities.

This paper also discusses how the traditional approach appears to be less effective when managing projects which entail high levels of complexity and uncertainty, and how the three theories can assist with addressing these challenges.

Therefore, it is proposed that a proposition for testing is:

P2. When an organization already controls the key project resources, does the availability of key project resources increased?

If an organization already possesses a key resource, this is likely to improve the timeliness with which the resource can be deployed to the project. For example, if a power generator company already employs an engineer specializing in gas turbines and is undertaking a project to install a gas turbine, it is likely that the engineer will be able to be assigned to the project in a timely manner. However, when another entity possesses these resources they may apply their power to withhold access to secure their own competitive advantage, or they may charge a premium for use of the resource thus increases project cost. Therefore, when an organization has ownership of a key resource it is less likely that the project will experience delays. However, organizations can increase the likelihood of project success (as measured by the iron triangle objectives), by applying the TOC, RBV/RAT and RDT in conjunction with traditional project management methodologies, tools and techniques to manage project complexity and uncertainty.

Accordingly, it is proposed that the following proposition be tested:

P3. When an organization already controls the key project resources, is the mobilization speed of key resources for the project increased?

If resources are readily available to the project team, then it is more likely that the project can be delivered in-scope and at budgeted cost. First, the likelihood of the project being delivered in-scope increases as a result of increased certainty that the required resources to deliver the project as planned are available for the project to draw upon (Rand, 2000). Second, the likelihood of the project being delivered at the budget costs will increase as there is no need to procure the required resources from the

market. Thus, the potential impacts of scarcity are mitigated. Accordingly, it is proposed that the following proposition be tested:

P4. When key project resources are readily available for use in the project, is the project is more likely to be successful?

If resources are provided to the project in a timely manner, then it is more likely that the project schedule will be less constrained and can be delivered on-time (Rand, 2000). Furthermore, it is also more likely that the project will be delivered in-scope and at budgeted cost as there will be less pressure for the project manager to cut corners or increase expenditure to improve the timeliness of the project. Therefore, it is proposed that the following proposition be tested:

P5. When key project resources are able to be rapidly mobilized, is the project more likely to be successful?

A conceptual schematic model (Figure 5) has been developed to synthesize the relationships between the three theories (TOC, RBT, RBV/RAT), the five project management process groups (IP, PP, EP, MCP CP), and the three dimensions of project success (scope, time, cost).

Initial testing: application to pratique cases

Prior to undertaking extensive empirical field research, with the underlying need for development of instruments for data collection for eventual testing of the propositions, an initial confirmation of their conceptual and theoretical validity has been undertaken through grounding with short case studies. Such confirmatory reflection using published cases is an established research method (Sauser *et al.*, 2009). The two case studies highlight the importance of considering resource scarcity during the Initiation and Planning processes of a project.

The following section provides an overview of The Channel Tunnel/Eurotunnel and London's Heathrow Terminal 5 projects; and illustrates how elements of the TOC, RBV/RAT and RDT are exhibited in the projects, which ultimately influenced delivery outcome of each project.

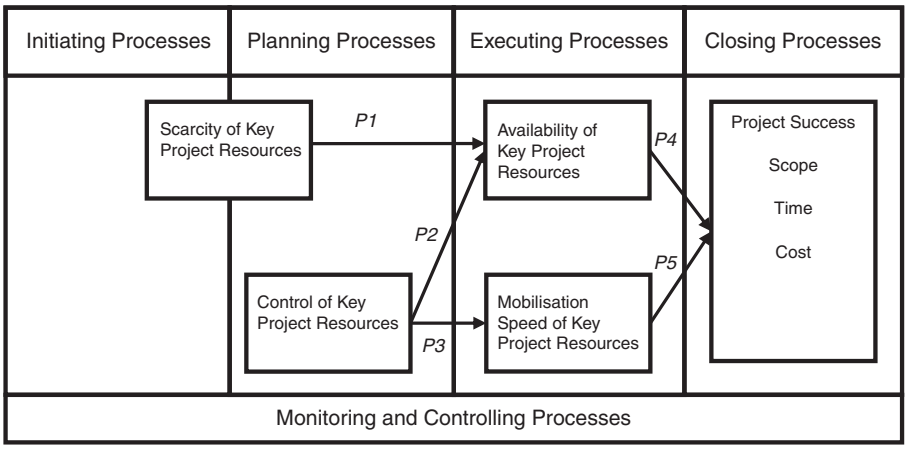


Figure 5.
Conceptual model embedded in project processes

The Channel Tunnel/Eurotunnel

The tunnel connects Great Britain and France via a rail link under the English Channel and, at 50.5 kilometres in length, is the longest underwater rail tunnel in the world. The tunnel opened in 1994 at an actual cost of £4.65 billion vs an original budget of £2.6 billion. It has been stated (Sauser *et al.*, 2009) that a key factor in the cost overrun was a failure to account for the scarcity of qualified civil and rail engineers in the UK, leading to the project needing to expend significantly more money to procure qualified staff; and resulted in delays in work due to longer than expected recruiting times. Recruiting costs were further compounded by the need to pay substantial sign-on bonuses to recruit qualified engineers from their existing roles. The delays then resulted in additional cost, as staff were required to work overtime in an attempt to get the project back on schedule.

This case study supports proposition *P1* as the scarcity of a key resource resulted in low resource availability. The case study also supports *P2* as the organization did not control the key resources and therefore the resources were not available when required. Additionally, the case study supports *P3* as the organization did not control the key resources, therefore mobilization times were reduced. Also, proposition *P4* is supported as the lack of availability of resources resulted in an increase in the budget as additional costs were occurred in an attempt to mitigate the lack of availability of key resources. Finally, case study supports P5 as the inability to rapidly mobilize key resources when they were required, impacted the project schedule and additional costs were incurred in an effort to bring the schedule under control.

London Heathrow Terminal 5 airport

Despite initial problems experienced during its opening, the Heathrow Terminal 5 (T5) project is considered a success as it achieved its goals of delivering the project on time, within budget and with an exemplary safety record. A large part of its success can be attributed to British Airport Authority's (BAA) innovative approach to project delivery.

During the planning phase, the client – BAA, assembled a core team of senior managers and consultants to explore alternative practices, technologies and ideas found in other industries and megaprojects, combining these to create a new project delivery process (Davies *et al.*, 2009). The team's knowledge of other projects and project management capabilities contributed to BAA's decision to occupy the role of systems integrator for the project. As systems integrator, BAA was responsible for the management and governance through each phase of the megaproject and outsourced a large portion of design and construction activities, whilst maintaining in-house capabilities to integrate components and deliver a fully functioning system against time, cost and quality targets.

Recognizing that the majority of megaprojects are unsuccessful based on time, cost, quality and safety objectives, BAA conducted a study of previous megaprojects and airport projects and identified two key areas that contributed to poor performance: the lack of collaboration among project partners, and the client's reluctance to assume responsibility for project risk (Brady and Davies, 2013). To overcome these challenges, BAA developed a cost-plus incentive contract called the T5 Agreement, assumed full responsibility for the risk and worked collaboratively in integrated project teams with first-tier suppliers to create innovative solutions. Although many first-tier suppliers understood the benefits of collaborative teams, some were unwilling or

unable to change their behaviour. Therefore, BAA implemented a large change programme to educate the supply chain and foster collaborative behaviours.

Prior to the T5 project, BAA also developed a Continuous Improvement Project Process (CIPP) which was primarily intended to improve the delivery of capital projects, with the longer-term objective being to utilize these capabilities in preparation for T5 (Davies *et al.*, 2009). The CIPP enabled BAA to develop capabilities in standardized designs (e.g. for offices and car parks) and modular components which could be used across routine projects, thereby enabling BAA to exploit the learning curve advantages and deliver cost-effective and profitable projects. The CIPP also helped BAA to understand its suppliers' capabilities and their ability to work under the environment of cooperation, trust and open-book accounting, which was later used under the T5 Agreement.

The T5 project was subject to a considerable number of project constraints, ranging from site constraints due to limited access and confined working areas, as well as over 700 conditions including restrictions on delivery and working times. To remove potential delays, BAA used pre-assembly and pre-fabrication techniques to enable suppliers to manufacture, assemble and test components, and practice their installation before being taken to the site. Just-in-time logistics were used to maintain an effective schedule of deliveries moving through the single site entrance, which was supported by the establishment of two dedicated consolidation centres for storage and materials handling located nearby. The typical risks and uncertainties associated with integration of new technologies were minimized by implementing a policy decision to use only existing or well-established technologies. Where new technologies were introduced, they were initially tested and proven either in trial or in operational environments, before being integrated into T5.

Structural complexity was mitigated by categorizing all the T5 subprojects into four main elements: buildings, rail and tunnels, infrastructure and systems. Supplier complexity (due to the multiple number of suppliers) and information asymmetries were managed by introducing a single-model environment (SME) to ensure the same information was available to all parties involved. BAA made efforts to learn from other firms that had pioneered SME technology, and carried out continuous refinements to the SME to ensure that it was implemented and used effectively during project execution. Finally, socio-political complexity was managed by implementing integrated project teams (as discussed previously) which were co-located, co-incentivized and co-responsible for the output of their projects.

The T5 project has been hailed as a successful project and exhibits application of the TOC, RBV/RAT and RDT to project management. In summary, the TOC methodology was applied to manage access and site constraints, reduce structural, supplier and socio-political complexities, and improve collaboration among project partners. Potential delays and risk were also mitigated by the implementation of pre-fabrication, pre-assembly and testing of components, and just-in-time logistics. Application of the RBV is demonstrated in various aspects of the project, including BAA's introduction of its core project team, fostering of collaborative behaviours, development and utilization of standardized designs, and its in-house project management capabilities. BAA's decision to take full acceptance for all project risks and implementation of a cost-plus incentive contract also assisted in improved performance, as it relieved suppliers of such burdens and encouraged innovative, collaborative behaviours. Finally, application of RDT is also demonstrated through its careful selection of first-tier suppliers and the long-term partnerships it developed with its suppliers as

part of the CIPP. Given the large number of external organizations involved, BAA were able to successfully manage the systems integration by working in collaborative teams and introducing the SME.

Most megaprojects are unsuccessful when measured against their time, cost, quality and safety objectives (Davies *et al.*, 2009), which may be due (in part) to the high levels of complexity and uncertainty associated with these projects. However, the T5 project provides an exemplary case of how the TOC, RBV/RAT and RDT were applied in conjunction with traditional project management practices to achieve project success.

T5 supports proposition *P1* as a key emphasis in its execution was the scrupulous management of key resources to ensure just-in-time resource availability. T5 also supports *P2* as BAA, whilst not controlling the key resources, instigated a novel and effective relationship with suppliers. Whilst BAA did not control the key resources, it ensured mobilization times were reduced, thereby supporting *P3*. Also, as explored with proposition *P4*, tight control on resources resulted in completion within budget. Finally, T5 supports *P5* as lean and agile project management techniques allowed rapid mobility of key resources.

Conclusions, limitations and future research direction

Shenhar and Dvir (2007, p. 10) argue:

> The classical drivers of project management are no longer sufficient in the current business environment. The traditional model fits only a small group of today's projects. Most modern projects are uncertain, complex and changing, and they are strongly affected by the dynamics of the environment, technology, or markets.

In an attempt to address these issues and enhance project management theory development, this paper argued that TOC, RBV/RAT and RDT can be integrated with traditional project management to increase project success. Each of these theories complements each other as the TOC focuses on process improvements and management of internal and external constraints, whilst RBV/RAT emphasizes development of a firm's resource-base and strategic assets, and RDT focuses on external resources and management of environmental dependencies. While the focus of the proposed model is operational, we argue that it underpins a strategic intent that will support planning at the strategic level. The success of a strategy is in its alignment to operational tactics, and vice versa.

Both case studies highlight the need to incorporate an understanding of the relative scarcity of resources into the strategy driving the project execution and planning of its scope. Furthermore, the case studies demonstrate the need for project managers to consider who controls resources in the external environment and to plan their projects to take account of these factors. Finally, the paper highlights the impact of resource availability and mobilization times upon the overall outcomes of the project, and the need for project managers to develop appropriate mitigation strategy for resource-related risks that are identified.

While the conceptual model developed in this paper has been explored using case studies, further empirical testing is required to further validate its general applicability to the management of projects. However, regardless of the limited testing undertaken in this paper, the model presented represents an advance in providing a framework for project management that encourages research in the field beyond the current focus on optimizing internal project processes. The conceptual framework is innovative in that it grounds project management within a wider environmental context and offers

opportunities for further refinement of the model to better tie the successful management of projects to improved strategic outcomes for organizations. Furthermore, the model presents an opportunity to better integrate the study of strategic management with that of project management. It is hoped that future research and empirical studies will assist in further advancing the theories developed in this paper.

The challenge, and possible limitation of this work, is to overcome any resistance from practitioners to embrace these theories. Our current activity involves training development programs with project managers where such issues will be explored.

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