BUILDING AND LEVERAGING CAPABILITIES TO DELIVER MEGAPROJECTS: THE CASE OF CH2M

Juliano Denicol, Andrew Davies, Tim Brady, and Mark Thurston

ABSTRACT

Considering the context of high capital investment globally, there is a practical call for studies exploring the factors that could potentially improve the efficiency of megaproject deliveries. The aim of this paper is to explain how project-based firms learn from its involvement in a series of one-off complex megaprojects and build capabilities to better deliver them. The study has examined CH2M, a project-based firm with capabilities in civil engineering, consultancy and program management, that recently was recognized as the world leader company in program management services. The research design comprised a qualitative research via single case-study method in a project-based organization with multiple embedded megaprojects. The learning within and between these megaprojects has enabled the company to develop a set of capabilities which can be applied in a variety of different markets. These capabilities cover both hard and soft skills which are translated into technical and managerial areas. This research argues that the involvement in a series of one-off megaprojects is a different phenomenon to understand, offer a new type of project capability building challenge for companies and adds to the literature on project capability building processes. What was unexplored so far is the balance between exploitation and exploration (routine vs innovative projects) faced by organizations that generate their income by delivering a portfolio of projects that includes, and is heavily influenced by, its involvement in repeatable large and complex megaprojects. Those organizations need to recognize the dilemma between the central corporation and the projects at the boundaries of the firm, as well as the necessity of creating and maintaining a balance at different levels, project, program and portfolio. All levels are constantly evolving and influencing each other, changing the organization as a whole towards the projects, following the logic embedded in the business model of project-based organizations.

KEYWORDS

Project-based firm, Organizational learning, Capability building, Megaprojects.

1. INTRODUCTION

The construction industry has been facing criticism over the last 30 years by its lack of productivity when compared with other industrial sectors (McKinsey Global Institute, 2017). The infrastructure investment across the world to sustain the global economic growth for the next decades is significant, the numbers vary according to the source but they all emphasize a single argument, of what has been called the "biggest investment boom in history" (Flyvbjerg, 2014). According to a widely cited report launched by McKinsey in 2013, USD 57 trillion is the amount forecasted to be spent from 2013 to 2030 (McKinsey Global Institute, 2013), while PwC estimates in USD 78 trillion the infrastructure spending between 2014 and 2025 (PwC, 2014). The difficulties, and arguably the lack of managerial capability, rely on the fact that these industries have different forms of organizational structures, high-volume industries have observed continuous productivity growth over the last 30 years, while industries that rely on temporary multi-organizational coalitions to deliver its products have faced problems to replicate their solutions and achieve economies of scale (Söderlund and Tell, 2009). In addition to the differences in production strategies and its intrinsic organizational structures, cross-project learning has been very challenging to achieve due to the uniqueness of these capital projects.

These projects are planned and sold as transformational with potential to change and improve the lives of millions. Considering the context of high capital investment globally, either in emergent countries for new assets or in developed economies to its upgrade and maintenance, there is a practical call for studies exploring the factors that could potentially improve the efficiency of megaproject deliveries. The current challenge is to find and develop case studies on successful megaprojects, as an antidote and counter argument for the many, and widely publicized, unsuccessful endeavors (Flyvbjerg, 2011). Data from several sources indicate that the capability to deliver these large and complex endeavors is not well developed, since a large proportion of these projects are delivered over budget and delayed (Flyvbjerg, 2016). There is a well-known stream of literature that builds on the work of Flyvbjerg et al. (2003) arguing that as a community of professionals we are unable to learn from one megaproject to another. The authors named this lack of managerial learning over time of "productivity paradox" and there is an extensive line of argumentation for negative factors around it, exploring "optimism bias", "strategic misrepresentation" and the lack of incentives for the supply chain to adopt continuous learning and internalize the knowledge. On the other hand, there is a stream of research, and practitioners, claiming for the necessity of capture the lessons (positive and negative) from previous complex and chaotic projects in order to improve and create benchmarks (Davies and Brady, 2000; Caldwell and Howard, 2010; Flyvbjerg, 2014).

The aim of this paper is to explain how project-based firms learn from its involvement in a series of one-off complex megaprojects and build capabilities to better deliver them. Project-based firms are companies that run their business, capture value and generate profit through projects. These companies explore a market niche where their clients are organizations that do not have the internal capability to develop the capital project in-house or are not willing to bear the risk and internalize it for strategic and contextual reasons (Davies and Brady, 2016). Governments are

usually the primary client for large infrastructure projects, since a large part of the public capital expenditure is dedicated to implement policies through projects. Project-based firms deliver their core competitive advantage to clients by recombining over time its own capabilities with the capabilities of an extended network of suppliers/partners. Considering the construction context where temporary multi-organization coalitions are the norm to deliver projects, the process of capabilities recombination is frequently understood as one-off. The literature about Complex Products and Systems (CoPS) points out that these systems need a set of specific capabilities to be produced, which can only be achieved by the exploitation of the main competitive advantage of several companies (Davies and Hobday, 2005). This paper revisits one of the fundamental tensions facing project-based organizations: how to create and assemble the knowledge required to address the needs of each individual project, whilst building the long-term capability required to improve the performance of multiple projects undertaken by the parent organization (Hobday, 2000; Gann and Salter, 2000; Davies and Brady, 2000; Sydow et al., 2004; Brady and Davies, 2004). While this tension has been addressed in some recent literature (Berggren et al., 2011; Lundin et al., 2016), there are surprisingly few in-depth case studies of how organizations manage this process over time and little or no research on how organizations learn and build capabilities required to produce complex, high-value one-off megaprojects – projects of USD 1 billion or more (Flyvberg et al., 2003).

2. THEORETICAL FRAME

Early research on project-based organizations (e.g. Hobday, 2000; Gann and Salter, 2000; Davies and Brady, 2000) was based on Chandler's (1990) understanding of organizational capability, however there have been considerable developments in the literature on organizational capabilities since the concept of the project-based organization was established (Davies and Brady, 2016). In this paper, we seek to consider how subsequent developments in our understanding of organizational capabilities may help us to illuminate how project-based organizations learn, acquire, integrate and apply new knowledge. This research will frame a project-based firm towards two theoretical lenses: (i) exploring the tensions between project capabilities and business process development (Gann and Salter, 2000); and (ii) the dilemma of building project capabilities to one-off and repeatable solutions, going from exploratory learning to capabilities exploitation (Davies and Brady, 2000; Brady and Davies, 2004; Davies and Brady, 2016).

2.1 PROJECT-BASED ORGANIZATIONS: THE TEMPORARY-PERMANENT DILEMMA

Increasingly, projects are becoming key elements and the engine for sustainable global economic growth (Davies and Hobday, 2005). The traditional high-volume industries, which are represented by hierarchical companies that focus on operations, such as car-manufacturers, oil and gas and consumer-goods, are increasing the proportion of projects as an alternative to generate innovations (Shenhar and Dvir, 2007). This movement is a reflection of the high level of service demanded by end-users, which are attended by a global market that supplies products and services with no boundaries, through a competition that is brutal for static and rigid businesses. The

companies driven by operations are gradually transforming themselves into project-based firms, relying on projects to achieve competitive advantages, ideally in a constant pace and difficult to imitate and replicate by competitors in a short and medium term (Lundin et al., 2016). In this process, some units and departments within large companies are configured as project organizations dedicated to achieve a specific purpose (Brady and Davies, 2004).

Project-based organizations (Hobday, 2000) and firms (Gann and Salter, 2000; Whitley, 2006) are permanent structures that create and capture value through projects and achieve competitive advantage to clients by managing a network of in-house units and external suppliers. Many project-based organizations design and produce complex products and systems such as telecommunications, aerospace, buildings and other high-value capital goods (Davies and Hobday, 2005). They face the challenge of delivering one-off projects tailored to each client's unique requirements, whilst building the knowledge required to manage multiple projects over many years and create mechanisms to embed the learning in the parent organization. Some authors use the term 'project capabilities' to identify the collective intellectual capital, or knowledge, embedded in a single firm, which is recombined and deployed to deliver projects (Davies and Brady, 2000; Lobo and Whyte, 2017). Today more and more firms have become involved in the production of very large and complex megaprojects, such as sporting events, infrastructure and urban developments (Flyvbjerg, 2014; Gil, 2009; Gil and Tether, 2011; Grabher and Thiel, 2015). However, research on the various types of project-based organizations – e.g. clients, contractors, consultants, major systems suppliers and other firms – involved in megaprojects has neglected to explore how the learning gained from participation in such large-scale endeavors can be captured and reused on future projects (Winch, 2014; Davies and Brady, 2016).

The research stream informed by the resource-based view (Teece and Pisano, 1994; Schreyögg and Kliesch-Eberl, 2007; Eisenhardt and Martin, 2000) distinguishes resources from capabilities, where the first is related to a series of individual inputs that an organization can acquire to support the production stage (associated with "what"), while the latter refers to the exploitation of the sum of organizational resources to achieve a specific outcome (linked with "how") (Helfat and Peteraf, 2003). Therefore, operational capabilities are a collection of processes and procedures, systematized in the form of routines, that aim to optimize the exploitation of its resources and maximize its value. Davies and Brady (2016) divide operational capabilities into project and functional capabilities that are deployed by project-based organizations to meet client's requirements and create value. The maturity of the exploitation of those resources by the company is important, at the pace that organizational capability is only recognized once there is trust on that specific capability and it is possible to identify its reproduction across a variety of projects with similar results (Shamsie et al., 2009).

In the dynamics of project-based firms, there is a disconnect between the activities and decisions at project and organization level, where the first tends to be unique and tailored to a particular context, and the second aims to generalize the actions through business processes to achieve a large amount of projects (Gann and Salter, 2000). Considering the nature of project-based settings, there is an intrinsic lack of stability

to build upon and create standardized routines. It is a dynamic environment where one firm is co-creating with other members of the project to deliver value to the client. This organizational form brings a tension between the exploitation of current capabilities located at the boundaries of the firm at project level and the strategic exploration of new markets by the central leadership (Brady and Davies, 2004). This separation explains the challenge of improving performance over time when extracting lessons learned from previous projects.

In a model of capability building proposed by Brady and Davies (2004), the project-based firm evolves towards a transition from exploratory to exploitation, which is represented by three distinct phases of organizational learning: 'within the project', 'project-to-project' and 'project-to-organization'. The goal is to create sustainable competitive advantage and transform exploratory learning into exploitative knowledge in order to sell it through repeatable solutions, generating value from economies of repetition (Davies and Brady, 2000). This evolution presents a dilemma between project capabilities and the business processes of the company, highlighting the necessity to create mechanisms to disseminate the learning and extract its hidden value. In this scenario, loops of knowledge internalization are developed to gradually insert the capabilities extracted from projects in the company wider environment (Gann and Salter, 2000). In addition, the context of project-based firms brings tensions and power regimes regarding the differences between projects and operations, which are represented by discussions over building capabilities through the involvement in temporary settings rather than in high-volume contexts.

The most important source of learning is when a firm becomes involved in a 'vanguard project' to explore how to move into a new technology and market base and then exploits the knowledge gained to execute a growing number of similar types of projects in the new base, initiating a long period of expansion – or 'project epoch' when the firm engages in the new activity over many years (Söderlund and Tell, 2009). Across the portfolio of project-based firms a small number of vanguard projects provide different pieces (capabilities, routines, processes) to be replicated and utilized in other more routine projects. By reconfiguring its capabilities from the involvement in different megaprojects, the company's current portfolio (and future clients) benefits from several cross-sectoral benchmarks. Although projects are usually observed and studied within the exploratory umbrella, in a project-based firm the business model will force the management leadership at the firm's core to create a balance between exploration and exploitation. Considering this perspective, the key competitive advantage for project-based firms is their capability to manage the portfolio of projects without losing the connection with each one of the projects to extract lessons and insert into the company business process (Gann and Salter, 2000).

3. RESEARCH METHODOLOGY

To achieve the overall aim, the study has examined CH2M, a project-based firm with capabilities in civil engineering, consultancy and program management, that recently was recognized as the world leader company in program management services (Engineering News Record, 2015). CH2M is an American organization with headquarters in Denver, Colorado, that conducts its business across 50 countries thought the mobilization of its 25.000 employees. The company is employee-owned,

organized in business groups and develop its projects advising clients in the industrial sectors of water, transportation, environmental and nuclear, oil, gas and chemical, and industrial and urban environments. This project-based firm was selected due to its involvement in a series of prominent megaprojects across the world over the last two decades which provided an opportunity to explore how the firm was learning from these and building the capabilities to take a leading role in the delivery of multiple megaprojects in the future. Some examples of the megaprojects that the firm has been involved in include: Rocky Flats Nuclear Production Facility; London 2012 Olympics; Crossrail; Thames Tideway Tunnel; High Speed 2; Thames Estuary Asset Management; Lower Thames Crossing; Heathrow Expansion; Kuala Lumpur-Singapore High-Speed Rail; Rio 2016 Olympics; Dubai 2020 Expo; and Qatar 2022 Fifa World Cup.

The research design comprised a qualitative research via single case-study method in a project-based organization with multiple embedded megaprojects (Eisenhardt, 1989; Yin, 2003). An extensive set of interviews is being undertaken across different hierarchical levels to explore CH2M's dimensions from May 2016 to May 2017, inspired by Langley's process research methodology which requires a combination of theory and data driven studies (Langley, 1999). The questions are both retrospective and in real time to shed light on the research problem (Alvesson and Sandberg, 2011), understand how the firm is evolving over time, capturing the knowledge and codifying the learning gained from previous experiences into organizational capability in order to apply across multiple megaprojects. The empirical data is being coded following an iterative process of analyzing the collected data against the research assumptions constructed deductively (Gioia et al., 2013).

4. KEY FINDINGS

The case study of CH2M provided the opportunity to explore how the firm's involvement as development and delivery partner in several megaprojects. The approach considered actions, mechanisms and events of learning from projects to improve the firm's performance, looking at the current projects and retrospectively to understand how capabilities were assembled and deployed, and what is the impact on the current and future projects. The firm has developed its engineering and program management capabilities through massive engagement with the USA government, developing infrastructure projects across the country since its foundation. In the 1900s, the Rocky Flats Nuclear Production Facility was a particularly challenging project - considered by many as the first megaproject conducted by CH2M. Representing a vanguard project for the firm, it was setting for a great deal of exploratory learning (Brady and Davies, 2004). During this project, the lessons learnt and knowledge sharing were restricted within the project.

After successfully delivering a project in "the most dangerous site in America", CH2M has transferred the learning from the United States to its subsequent megaproject in the United Kingdom, London 2012 Olympics, which was embedded in a different continent with contrasting cultural and working behaviors. After gaining experience in Rocky Flats, CH2M key staff were relocated to share their experiences, assembly and mentor the new project team. A number of tools and dynamics were used to reflect on the previous success, codify the knowledge and reconfigure it to

relevant applications in the new context. However, it is necessary to recognize that at the time of the Olympics, the UK construction context was in a unique position and contextually influenced by having experienced both huge failure and success, in the cases of Wembley Stadium and Heathrow Airport Terminal 5, respectively.

The empirical evidence suggests that at the time of Rocky Flats and beginning of London 2012 Olympics, the knowledge was confined on the minds of a group of individuals and not widely spread in the firm, systematically embodied in its business processes. Therefore, although the company had a massive success delivering the Rocky Flats clean up, it was only after the successful translation of the approach to London 2012 Olympics that the practices were extensively deployed internally impacting other major programs in the portfolio. This evidence suggests that when the capability is being created on megaprojects, the company can achieve a faster responsiveness internalizing the knowledge and replicating it relying just on a few high-profile programs, without being exposed to a large variety of projects.

London 2012 Olympics is considered worldwide as a case of study in successful megaproject management. CH2M used the learning gained from the project to improve the delivery of subsequent megaprojects around the world. However, one-off complex projects are different of regular projects, at the same pace that repeatable involvement in these megaprojects can be considered another category of capability building than ordinary projects, where the learning is constantly evolving to address the particular characteristics of each project in complex and highly political environments. Whereas improving the performance of routine, simple projects depends on economies of repetition, delivering a number of megaprojects more efficiently is about learning to build and maintain long-term relationships with clients and contractors. The megaproject context provides an extended horizon of time for engagement and learning, where project-based firms are exposed to several interfaces according to the phases of the project. The starting structure of the project evolves quickly with an increasing number of stakeholders, challenging the firms to manage new interfaces, being flexible and adaptive to cope with complexity. Another feature of those programs that contribute to enhance the learning and accelerate the dissemination of practices is its visibility, once the project is constantly under public scrutiny, either failures or successes are likely to be exhaustively discussed by the media, increasing the interface period that the company is allocating resources to manage it.

The learning within and between these megaprojects has enabled the company to develop a set of capabilities which can be applied in a variety of different markets. These capabilities cover both hard and soft skills which are translated into technical and managerial areas. The former included capabilities such as tunneling (e.g. from Crossrail which are now being exploited in the Thames Tideway Tunnel project). The latter relate to the approach CH2M has developed to engage the client and other important project actors (such as the supply chain and external stakeholders) in a collaborative way throughout the project lifecycle. This is not a one-size fits all approach as each megaproject has its own particular characteristics which have to be understood and taken into account in the design of the governance and overall structure of the delivery model. In each of those projects there is a balance between the reuse and renewal of capabilities, where the knowledge for renewal might come

from a combination of internal thinking and from project partners, usually members of the joint venture.

Operational capabilities are being created and disseminated within the projects, transferred between projects, and shaped for the new project in a balance of reuse and renew, in initiatives like the innovation strategy that clearly is being copied, adapted and tailored to each environment (from Crossrail to other major programs, before through isolated initiatives and now via The Infrastructure Industry Innovation Platform – I3P). There are two levels to be balanced towards exploitation and exploration, project and business levels, there are ad-hoc initiatives being systematized to deploy different types of knowledge (technical, process, and market) to different levels. It is possible to observe that the capabilities being developed at CH2M include both operational capabilities and dynamic, in a process of capabilities integration, some from within the company and others complementary from the external market. Since there are capabilities being utilized at the strategic level across the business for decisions such as resource allocation and prioritization of projects, this research can be expanded through an extensive analysis of the dynamic capabilities literature.

CH2M is currently exploiting the London 2012 capabilities in a business-led perspective, where packages (slices or bundles) of the capabilities developed to the Olympics are being reconfigured internally and sold by the top leadership to other megaprojects across the world. Over time, the exploratory learning is transformed into exploitative capabilities and routines, having its impact maximized by economies of repetition in multiple megaprojects, following a top-down decision making. The project capability building model is suitable to frame this company since it aims to map the entire evolutionary process of the organization, mapping the transition stages from exploratory learning in vanguard projects to exploitation in repeatable solution. As an illustration, CH2M is currently drawing upon its role at London 2012, where it acted as a member of the delivery partner joint-venture. The company internalized this knowledge and is now leveraging it as a core capability, reconfiguring it in different formats to address the necessities of each project. In each case the specific role has varied in some ways but CH2 has evolved its capability to help define an appropriate balance of activities and roles within the partnerships depending on the respective capabilities of the client and their own organization.

Considering an evolution towards megaprojects over the last decades, two key ingredients are critical to enhance the company's competitive advantage in the market and adherent to the theoretical frameworks discussed in this research: (i) Transfer of capability through people vs central initiatives; and (ii) Soft skills as key competitive advantage.

4.1 TRANSFER OF CAPABILITY THROUGH PEOPLE VS CENTRAL INITIATIVES

The organizational capability required to deliver megaprojects is embedded in individuals that have participated of prior projects and enabled their delivery. They are responsible for transmitting the knowledge to the organization, also known as knowledge brokers that help to institutionalize it, creating a sense of property and ownership of that knowledge, acting as carriers of key pieces to create an organizational memory and culture over time. Therefore, the importance of people to

transfer capabilities across megaprojects creates the risk of dependence and emphasize the necessity for systematic central initiatives to disseminate the knowledge. This tension relates to the disconnection between programs and portfolio and the necessity of constant loops in this interface in order to evaluate the practices in each megaproject. In this scenario, it would be possible to internalize the knowledge and replicate in other large scale projects across the portfolio through the reutilization of that practice or its reconfiguration, combining with internal and/or external knowledge. A central database is available to all corporate members including those located at the boundaries of the firm embedded in client organizations, which is described as the company's written intellectual capital encompassing internal systems, tools and procedures. One challenge is to maintain this central system updated with the newest resources that are constantly emerging from each megaproject, as well as to disseminate those advancements to the correct audience internally. Considering the pace of enhancements across several programs, it is critical to shortened this loop of knowledge internalization creating the dedicated role of 'knowledge integrator and disseminator', in order to enable responsiveness to the organization and fully exploit the benefits of this knowledge.

Knowledge is integrated and transferred at the bidding stage in order to develop a winning solution, leveraging previous experiences. For example, best practices, the reputation of the projects, and the caliber of the people that can be relocated. Strategically, the company provides exposure to people on major programs, enhances their CVs and put their names in the next bid to win new programs. The bid for Thames Tideway Tunnel was built based on the learning from the Olympics and other complex tunnel projects across the world. However, considering the length of these endeavors there is a huge potential for continuous knowledge integration throughout the project life-cycle. Another key initiative related to knowledge evolution is to involve potential project leaders in the bidding process and once it is successful, enable a smooth transition to the development or delivery stages of that major program. This practice is observed in most of the recent major programs and draws upon the fact that there is a lot of intellectual capital during the bidding and the joint venture formation that it is a sensible decision to maintain those individuals providing continuity in order build from the level already achieved.

4.2 SOFT SKILLS AS KEY COMPETITIVE ADVANTAGE

The key competitive advantage perceived by the market is definitely not about hard skills, every major company will have virtually the same systems, tools and procedures for program management, everyone is technically competent, they just bundle, present and sell it differently. It is all about soft skills, where the relationship between client and development/delivery partner is emphasized, the behavior of key suppliers is being increasingly assessed and weighted as a major decision factor by infrastructure clients in mature markets. In a scenario where the technical capability is increasingly not a winning factor, clients are considering the type of organization they will partner with and see in the office for an extended horizon of time. In light of this fact, it is not a matter if organization A or B can deliver it, but rather who better reflects the client's culture, who is flexible enough to have a constant dialogue understanding the evolving necessities, and work towards the same vision to co-create the solution to be implemented. It is about understanding the natural evolution of the

industry where clients are becoming more sophisticated and do not look for off-the-shelf solutions to their problems. The ability to be a collaborative and flexible organization, described by many as listeners before doers, is a key ingredient of the company's competitive advantage. CH2M spirit of collaboration and collegiate is something unique and it is possible to track this organizational capability to the individual level by observing these principles and values on people's behavior every day. Although the company is known for its external collaborative behavior with clients, this open and transparent approach also reflects the internal dynamics, helping to stimulate the flow of information within the company. However, an individual still need to ask the right questions to get the answers because the other very skilled person on the line from a distant geography needs to have its knowledge triggered by questions in order to fully transfer the embedded knowledge through a variety of explanations.

The learning of working collaboratively in a variety of relationship structures (client-delivery partner, integrated client teams, and joint-ventures) can be transferred across projects, being influenced by the level of management required by the client. Understanding that CH2M is a client-centric organization, it can adapt and tailor its framework to all sorts of clients, from those that are naive and want a day-to-day or micro management to a mature enough to tell 'what' they want and by 'when', empowering the delivery partner to do the 'how', which is what they are being very well paid for. However, the delivery partner will always be as good as the client allows, regardless its world class capabilities, the client is the player providing the instructions and pulling the strings, if the client does not empower the delivery partner to deliver, there is a large opportunity cost being lost once the full exploitation of the key competitive advantage of the organization that is acting as development or delivery partner.

5. CONCLUSIONS AND RECOMMENDATIONS

The industry itself and clients are currently more willing to work collaborative and accept risks than 10-15 years ago where arm's length and fixed price contracts were the norm. Clients are increasingly engaging with their supply chain, removing boundaries to work collaboratively in a clear process of absorbing that knowledge to become more intelligent. In this context, CH2M can leverage its client-centric approach and sell its integrative, flexible and collaborative approach to develop together a tailored solution for the client's requirements.

As a resultant of the theoretical framing of the empirical data, this research presents CH2M's case to improve the understanding of how project-based firms build capabilities in a systematic manner through its learning from multiple complex one-off megaprojects. Drawing upon CH2M's experiences, the study contributes to the capability literature by exploring the gap of building capabilities to better deliver megaprojects towards repeatable involvement on them. The challenge is common to different actors of the supply chain, both demand and supply side, clients and delivery partners, have been facing the problem of building capabilities through its involvement in large-scale endeavors. This research argues that the involvement in a series of one-off megaprojects is a different phenomenon to understand, offer a new type of project capability building challenge for companies and adds to the literature

on project capability building processes. This research extends previous work on project capabilities which was based on research in the telecommunications sector (Davies and Brady, 2000; Brady and Davies, 2004) and the power generation sector (Söderlund and Tell, 2009) to the construction sector.

What was unexplored so far is the balance between exploitation and exploration (routine vs innovative projects) faced by organizations that generate their income by delivering a portfolio of projects that includes, and is heavily influenced by, its involvement in repeatable large and complex megaprojects. Those organizations need to recognize the dilemma between the central corporation and the projects at the boundaries of the firm, as well as the necessity of creating and maintaining a balance at different levels, project, program and portfolio. All levels are constantly evolving and influencing each other, changing the organization as a whole towards the projects, following the logic embedded in the business model of project-based organizations. In this context, there is a managerial opportunity to observe the organization through a systemic lens, consolidate at the core the learning that is ongoing at the frontiers and make strategic decisions to create balance in the projects, within projects and across the portfolio.

REFERENCES

Alvesson, M., and Sandberg, J. (2013). Constructing research questions. Los Angeles, CA: Sage.

Berggren, C., Bergek, A., Bengtsson, L., Hobday, M., and Söderlund, J. (2011). Knowledge Integration and Innovation. Critical challenges facing international technology-based firms. Oxford: Oxford University Press.

Brady, T., and Davies, A. (2004). "Building project capabilities: From exploratory to exploitative learning," *Organization Studies*, 25(9), 1601–1621.

Caldwell, N., and Howard, M. (2010). Procuring complex performance: studies of innovation in product-service management. Routledge, Oxford, UK. ISBN: 9780415800051.

Chandler, A. D. (1990). Scale and Scope: The Dynamics of Industrial Capitalism. Belknap, Harvard University Press, Cambridge. ISBN: 978-0674789951.

Davies, A., and Brady, T. (2000). "Organisational capabilities and learning in complex product systems: towards repeatable solutions," *Research Policy*, 29, 931–953.

Davies, A., and Brady, T. (2016). "Explicating the dynamics of project capabilities," *International Journal of Project Management*, 34(2), 314–327.

Davies, A., and Hobday, M. (2005). The Business of Projects: Managing Innovation in Complex Products and Systems. Cambridge University Press, Cambridge. ISBN: 9780521843287.

Eisenhardt, K. M. (1989). "Building theories from case study research," *Academy of management review*, 14(4), 532–550.

Eisenhardt, K. M., and Martin, J. A. (2000). “Dynamic capabilities: what are they?” *Strategic Management Journal*, 21, 1105–1121.

Engineering News Record. (2015). The 2015 Top 50 Program Management Firms. Retrieved from: http://www.enr.com/toplists/2015_Top_50_Program_Management_Firms

Flyvbjerg, B. (2011). Over budget, over time, over and over again: Managing major projects. In: P. W. G. Morris, J. K. Pinto, & J. Söderlund (Eds.), The Oxford Handbook of Project Management (pp. 321–344), Oxford University Press, Oxford.

Flyvbjerg, B. (2014). “What you should know about megaprojects and why: an overview,” *Project Management Journal*, 45(2), 6–19.

Flyvbjerg, B. (2016). The oxford Handbook of Megaproject Management. Oxford: Oxford University Press. (Forthcoming).

Flyvbjerg, B., Bruzelius, N., and Rothengatter, W. (2003). Megaprojects and risk: an anatomy of ambition. Cambridge University Press: Cambridge.

Gann, D. M., and Salter, A. J. (2000). “Innovation in project-based, service-enhanced firms: the construction of complex products and systems,” *Research Policy*, 29, 955–972.

Gil, N. (2009). “Developing cooperative project-client relationships: how much to expect from relational contracts,” *California Management Review*, 51(2), 144–169.

Gil, N., and Tether, B. (2011). “Project risk management and design flexibility: analysing a case and conditions of complementarity,” *Research Policy*, 40, 452–466.

Gioia, D. A., Corley, K. G., and Hamilton, A. L. (2013). “Seeking qualitative rigor in inductive research: Notes on the Gioia methodology,” *Organizational Research Methods*, 16(1), 16–31.

Grabher, G., and Thiel, J. (2015). “Projects, people, professions: trajectories of learning through a mega-event (the London 2012 case),” *Geoforum*, 65, 328–337.

Helfat, C. E., and Peteraf, M. A. (2003). “The dynamic resource-based view: capability lifecycles,” *Strategic Management Journal*, 24, 997–1010.

Langley, A. (1999). “Strategies for theorizing from process data. Academy of Management Review,” 24(4), 691–710.

Lobo S., and Whyte J. (2017). “Aligning and Reconciling: Building project capabilities for digital delivery,” *Research Policy*, 46, 93–107.

Lundin, R. A., Arvidsson, N., Brady, T., Ekstedt, E., Midler, C. and Sydow, J. (2016). Managing and Working in Project Society: Institutional Challenges of Temporary Organizations. Cambridge University Press, Cambridge. ISBN: 9871107077652.

McKinsey Global Institute. (2013). Infrastructure Productivity: How to Save $1 Trillion a Year. McKinsey and Company. Retrieved from: http://www.mckinsey.com/~/media/McKinsey/Industries/Infrastructure/Our%20Insights/Infrastructure%20productivity/MGI%20Infrastructure_Full%20report_Jan%202013.ashx

McKinsey Global Institute. (2017). Reinventing construction: A route to higher Productivity. Retrieved from: http://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/reinventing-construction-through-a-productivity-revolution

PwC. (2014). Capital project and infrastructure spending Outlook to 2025. Available at: https://www.pwc.com/gx/en/capital-projects-infrastructure/publications/cpi-outlook/assets/cpi-outlook-to-2025.pdf

Schreyögg, G., and Kliesch-Eberl, M. (2007). "How dynamic can organizational capabilities be? Towards a dual-process model of capability dynamization," *Strategic Management Journal*, 28(9), 913–933.

Shenhar, A. J., and Dvir, D. (2007). Reinventing project management: The diamond approach to successful growth and innovation. Boston, MA: Harvard Business School Press. ISBN: 9781591398004.

Söderlund, J., and Tell, F. (2009). "The P-form organization and the dynamics of project competence: project epochs in Asea/ABB, 1950–2000," *International Journal of Project Management*, 27(2), 101–112.

Sydow, J., Lindkvist, L., and DeFillippi, R. (2004). "Project-based organizations, embeddedness and repositories of knowledge," – *Editoral. Organization Studies*, 25(9), 1475–1489.

Teece, D., and Pisano, G. (1994). "The dynamic capabilities of firms: an introduction. *Industrial and Corporate Change*, 3(3)," 537–556.

Whitley, R. (2006). "Project-based firms: New organizational form or variations on a theme?" *Industrial and Corporate Change*, 15(1), 77–99.

Winch, G. M. (2014). "Three Domains of Project Organising," *International Journal of Project Management*, 32(5), 721–731.

Yin, R. K. (2003). Case study research: Design and methods. Thousand Oaks, CA: Sage.