



The Megaproject-based Firm: Building programme management capability to deliver megaprojects

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ABSTRACT

The rapid growth in demand for large-scale infrastructure around the world calls for a new type of organisation, which we label the Megaproject-based Firm (MBF). We conceptualise the MBF as a core permanent entity that delivers multiple megaprojects with partners in project networks, in several large temporary organisations crossing the boundaries of the firm. We use 78 interviews to identify how the learning within and between these megaprojects has enabled the firm to build programme management capabilities over time. Our results show that adaptability, flexibility, and the design of the roles and responsibilities between clients and delivery partners are critical ingredients of programme management. Megaprojects should be delivered through a collaborative relationship *with* clients, not *for* clients. The involvement in a series of megaprojects in parallel and sequentially offers a new type of project capability building challenge for firms, adding to the literature on project-based firms and project capabilities.

1. Introduction

Project-based firms (PBFs) are companies that run their business, capture value, and generate profit through projects (Gann & Salter, 2000; Whitley, 2006). These firms explore a market niche where their clients are organisations 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 & Brady, 2016). PBFs create, leverage, and recombine capabilities located in-house and in their network of suppliers and partners to provide clients with high-value project solutions (Gann & Salter, 2000; Hobday, 2000). An important way of building capabilities is by using the learning (positive and negative) gained from previous complex projects to improve performance (Denicol et al., 2020; Flyvbjerg, 2014).

Previous studies on complex products and systems explored various types of project-based organisations (Hobday, 2000) involved in inter-organisational projects across several industrial sectors. While this literature focused on high-value projects, it did not address how PBFs manage megaprojects, which has become an increasingly important delivery model for the construction of large-scale infrastructure around the world (Denicol et al., 2020). Firms have increasingly become involved in the production of large and complex megaprojects, such as

sporting events, infrastructure and urban developments (Davies & Mackenzie, 2014; Denicol et al., 2020; Gil, 2009; Gil & Tether, 2011; Grabher & Thiel, 2015). Governments are often the primary client for large infrastructure projects, since a large part of the public capital expenditure is dedicated to implementing policies through projects (Denicol et al., 2021).

PBFs involved in infrastructure delivery face the challenge of capturing knowledge, experience and reputation gained while working on one megaproject and transferring it to the next. Yet megaprojects are comprised of large temporary multi-organisation coalitions and defined as unique, one-off and novel activities (Denicol, 2020). Therefore, building capabilities, exploiting economies of repetition (Davies & Brady, 2000), replicating solutions to obtain economies of scale (Söderlund & Tell, 2009), and learning from one megaproject to the next is a major challenge for PBFs.

This research explores the challenges of how a PBF learns from its involvement in a series of megaprojects and builds capabilities to better deliver them. Megaprojects are sophisticated inter-organisational spaces and offer a platform for capability development based on rich co-creation with multiple partners. Megaprojects are strategic major programmes for the firm, which stimulate the transformation and capability building through the involvement in multiple megaprojects, in parallel

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and sequentially. This paper explores one of the fundamental tensions facing project-based organisations: 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 organisation (Brady & Davies, 2004; Davies & Brady, 2000; Gann & Salter, 2000; Hobday, 2000; Sydow et al., 2004). While this tension has been addressed in some recent literature (Berggren et al., 2011; Lundin et al., 2015), there are surprisingly few in-depth case studies of how PBFs manage this process over time and little or no research on how organisations learn and build capabilities required to produce complex, high-value one-off megaprojects. We examine the case of a PBF globally renowned by its programme management services, with the novel aspect of longitudinally analysing the firm's capability building process from its involvement in multiple megaprojects over time.

We suggest that the rapid growth in demand for large-scale infrastructure around the world calls for a new type of organisation, which we call the Megaproject-based Firm (MBF). We conceptualise the MBF as a core permanent entity that delivers multiple megaprojects in collaboration with partners, therefore multiple temporary organisations crossing the boundaries of the firm. The permanent core should (and needs) to adapt over time to mirror the complexity and flows of different megaprojects happening across the boundaries of the firm. This rich dynamic allows the permanent organisation to supply the multiple temporary organisations with services that are constantly evolving – given the life cycle of each megaproject, the demands of clients, the types of contracts awarded by the clients to the MBF, the regulatory environment, and the political domain.

2. Theoretical framework

Early research on project-based organisations (e.g. Hobday, 2000) and PBFs (Davies & Brady, 2000; Gann & Salter, 2000) was based on understanding how firms develop organisational capabilities to manage multiple projects. We consider how subsequent developments in our understanding of organisational capabilities (Davies & Brady, 2016; Leiringer & Zhang, 2021) may help us to illuminate how PBFs learn, acquire, integrate, and apply new knowledge and experience. This research explores a PBF through two theoretical lenses: (i) exploring the tensions between project capabilities and business process development (Gann & Salter, 2000); and (ii) the dilemma of building project capabilities to one-off and simultaneously to repeatable solutions, going from exploratory learning to capabilities exploitation (Brady & Davies, 2004; Davies & Brady, 2000; Davies & Brady, 2016).

2.1. Project-based firms: the temporary-permanent dilemma

It is now widely recognised that projects provide a flexible and adaptive structure used by an increasing number of organisations across industries to solve one-off problems, drive innovation and produce complex capital goods and services in a globally competitive knowledge-based economy (Davies & Hobday, 2005; Shenhar & Dvir, 2007; Sydow et al., 2004; Whitley, 2006). Many of the world's largest firms (e.g. Google, Tesla and Apple) are project-supported organisations (Lundin et al., 2015). They depend on projects to develop and create new products and services in competitive markets, but their core capabilities are established to produce products and services in high-volume. Lundin et al. (2015) provide a typology of organisations to identify how projects are formed and increasingly used in three organisational contexts: the project-based organisation whose core business is delivering projects; the project-supported organisation (as above); and the project network including the growing use of large, temporary inter-organisational structures.

The project-based organisation (Hobday, 2000) and PBF (Gann & Salter, 2000; Whitley, 2006) are different terms used to describe permanent structures that create and capture value through projects and

achieve competitive advantage by managing a network of in-house units and external suppliers. A firm or organisation is *project-based* when the majority of its design and production activities are performed as projects for external clients and embedded in a permanent organisation set up to execute projects and find new work when each project is completed. Whereas the project-based organisation may also refer to public entities motivated by welfare maximisation, this paper focuses on how private profit-maximising PBFs develop and harness capabilities to achieve competitive advantage. PBFs have little time to capture the learning from each one-off, unique project and often face difficulties in developing the capabilities to improve the execution of projects (Prencipe & Tell, 2001), replicate solutions (Davies & Brady, 2000) and achieve economies of scale and scope (Söderlund & Tell, 2009). PBFs have to resolve a significant temporary-permanent dilemma (Sydow et al., 2004). They face the challenge of delivering one-off (temporary) 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 (permanent) parent organisation.

A large body of research has considered how PBFs develop the capabilities to design and produce complex products and systems such as telecommunications, aerospace, buildings and other high-value capital goods (Davies & Hobday, 2005). Some authors use the term *project capabilities* to identify the knowledge, experience and skills embedded in a single firm, which is recombined and deployed to deliver multiple projects over time (Davies & Brady, 2000; Lobo & 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 (Denicol et al., 2020; Flyvbjerg et al., 2003; Gil, 2009; Gil & Tether, 2011; Grabher & Thiel, 2015). However, research on the various types of PBFs – 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 endeavours can be captured and reused on future projects (Davies & Brady, 2016; Denicol et al., 2021; Winch, 2014). This paper extends Gann and Salter's (2000) original study by considering how a PBF develops the capabilities to manage large-scale infrastructure megaprojects over many years.

2.2. The PBF and organisational capabilities

Previous research on the project-based organisation and PBF (Davies & Brady, 2016; Leiringer & Zhang, 2021) was heavily influenced by the adjacent literature on the organisational capabilities (Nelson & Winter, 1982; Chandler, 1990) and the resource-based view (RBV) (Barney, 1991) which focus on the internal resources, routines and capabilities of the firm. Research on routines and organisational capabilities was pioneered by Nelson and Winter's (1982) evolutionary perspective on economic growth. When performed repeatedly, the skills of individuals become routinized. Routines refer to all of the predictable, repetitive and reliable patterns of productive activities performed by firms. Routines play the same role as genes in biological evolution. To survive and grow, a firm must be able to repeat and modify routines in a changing environment. In this framework, routines form the building blocks of a firm's organisational capabilities. Organisations depend on higher-order procedures – or dynamic capabilities (Zollo & Winter, 2002) – to modify and change lower-order operational capabilities. However, firms often face difficulties in modifying their routines because some routines are based on tacit knowledge and skills, embodied in individuals which cannot easily be articulated.

Inspired by Penrose's (1959) foundational work, the capabilities and RBV research emphasises that firms possess specialised resources (the knowledge and skills of workers) which are mobilised in different combinations to keep pace with a changing technology and market environment (Barney, 1991; Barney et al., 2011; Eisenhardt & Martin, 2000; Schreyögg & Kliesch-Eberl, 2007). Central to the RBV approach is

the idea that a firm is a bundle of human (intellectual capital, skills and knowledge) and physical (capital equipment and technology) resources. Resources refer to a series of individual inputs that an organisation can acquire to support the production stage (associated with “what”), while capabilities designate how a firm exploits the sum of organisational resources to achieve an outcome (linked with “how”) (Helfat & Peteraf, 2003). Firms develop, adjust and build resources and capabilities to keep pace with the rate of change in a firm’s environment, such as the development of new technologies and markets. Resources and capabilities that are distinctive, unique and difficult to replicate are a source of competitive advantage (Barney, 1991).

In an attempt to combine evolutionary and RBV perspectives, Teece et al. (1997) argued that in fast-changing environments firms depend on dynamic capabilities to upgrade, modify and reconfigure a firm’s internal and external resources, routines and capabilities. Operational capabilities are a collection of processes and procedures, systematised in the form of routines, that aim to optimize the exploitation of its resources and maximize its value in a firm’s existing technologies and markets. The maturity of the exploitation of those resources by the company is important, as organisational capability is only recognised 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). Dynamic capabilities are higher-order routines used to change operational routines and capabilities (Helfat & Peteraf, 2003; Helfat & Winter, 2011). Eisenhardt and Martin (2000) developed a contingency approach to RBV research on dynamic capabilities. In moderately dynamic environments, dynamic capabilities are based on tacit knowledge and experience built over years to address recurring and largely predictable problems. In high-velocity markets, dynamic capabilities must address unforeseeable uncertainties and master rapidly changing conditions.

Studies of the PBF embraced the capabilities and RBV frameworks, but suggested additional skills, routines and capabilities are required to successfully cope with the complexity, novelty and temporary nature of projects (Brady & Davies, 2004; Davies & Brady, 2000; Gann & Salter, 2000; Hobday, 2000). Research on PBFs identifies a disconnect between the activities and decisions at project and organisation level, where the first tends to be unique and tailored to a particular context, and the second aims to generalize the actions through standardised procedures and routines required to support a large number of projects (Gann & Salter, 2000). PBFs depend on dynamic capabilities to address potential conflicts that arise over resources allocated to projects and business processes (Gann & Salter, 2000). Considering the temporary nature of project-based settings, it is often assumed that there is an intrinsic lack of stability and repetition needed to build upon and create 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 organisational form brings a tension between the exploitation of current capabilities located outside the boundaries of the firm at the project level and the strategic exploration of new markets by the central leadership (Brady & Davies, 2004). This separation explains the challenge of improving performance over time when extracting lessons learned from previous projects (Denicol et al., 2020).

2.3. Organisational capabilities and megaprojects

Research argues that PBFs depend on project capabilities to achieve improvements in performance and to grow and diversify in new technologies and markets (Brady & Davies, 2004; Davies & Brady, 2000). Davies and Brady (2000) challenge the widely held assumption that all projects perform unique and non-recurring tasks. When a PBF performs projects which contain similar and repetitive activities, then resources, knowledge (tacit and codified) and routines can be developed to bid and efficiently execute multiple projects in an existing technology or market. When tasks are repeated, a PBF with project capabilities can obtain economies of repetition by performing tasks more reliably and

efficiently. In more recent work, Davies and Brady (2016) suggest that project capabilities are a subset of operational capabilities and PBFs depend on dynamic capabilities to modify and reconfigure lower-order project routines and capabilities.

In a model of project capability building, Brady and Davies (2004) suggest that PBFs may transition over time from exploration to exploitation, which is represented by three distinct phases of bottom-up organisational learning: within the project, project-to-project, and project-to-organisation. The goal is to create sustainable competitive advantage and transform exploratory learning into exploitative knowledge by building the capabilities to offer repeatable solutions, generating value from economies of repetition (Davies & Brady, 2000). The process of project capability building is initiated when a PBF launches a vanguard project to explore how to address new technologies or market requirements (Brady & Davies, 2004). The process is completed when a PBF makes top-down decisions to exploit the learning gained from the experience and implement the strategic transformation required to support the move into the new line of projects.

This evolution presents a dilemma between project capabilities and the business processes of the PBF highlighting the necessity to create mechanisms to capture and disseminate learning. In this process, loops of knowledge internalisation are developed to gradually embed the capabilities extracted from projects in the firm’s wider environment. The knowledge might lead to the new routines and capabilities that may be reused across multiple projects (Gann & Salter, 2000). One or more vanguard projects may initiate a long period of expansion – or project epoch – when a PBF engages in the new activity over many years (Söderlund & Tell, 2009). Across the portfolio of PBFs a small number of vanguard projects provide different pieces (capabilities, routines, processes) to be replicated and utilized in other more routine projects.

Firms involved in the delivery of multiple megaprojects over many years have opportunity to learn from the experience of complex one-off projects and building the capabilities to improve its performance by identifying, modifying and reconfiguring its routines and capabilities from the involvement in each different megaproject. The firm’s current portfolio (and future clients) may benefit from benchmarking the experience gained from the delivery of megaprojects in a variety of sectors. Although megaprojects are usually considered novel, exploratory and unique, a PBF engaged in a stream of megaprojects has an opportunity to identify what elements can be successfully codified and repeated across many future megaprojects. In this way, the PBF can strike a balance between exploration and exploitation while executing current megaprojects and preparing for the future. Considering this perspective, the key competitive advantage for PBFs is their capability to manage the portfolio of projects, capture the learning from each endeavour, identify transferable routines and capabilities, and incorporate relevant new knowledge in the firm’s existing business process (Gann & Salter, 2000).

Research on the capabilities of the PBF draws on an eclectic range of RBV, evolutionary and dynamic capabilities perspectives. Despite the recognition that firms must redeploy and integrate internal and external resources and capabilities, PBF research has paid little or no attention to how such permanent organisations learn from delivering a portfolio of megaprojects. Such large inter-organisational endeavours are often located outside the boundaries of the firm and involve working in temporary teams, integrated and collocated with clients. The traditional view of external development of capabilities emphasises mainstream corporate dynamics such as acquisitions, mergers, and alliances. However, the project organising environment and the business model of a PBF may challenge this logic, offering a rich setting to explore the development of capabilities. After reviewing the capability literature, Leiringer and Zhang (2021) found that only a small number of papers on project organising could be classified as exploring the development of internal and external capabilities in an inter-organisational context. This research is novel and contributes to the literature by analysing the rich case of a PBF involved in a sequence of innovative megaprojects over

time, revealing the firm's capability development journey to integrate and internalise the knowledge from individual megaprojects, for subsequent dissemination and exploitation across the portfolio of megaprojects.

3. Research methods

The research design comprises a qualitative study via case-study method in a PBF with multiple embedded megaprojects (Eisenhardt, 1989; Yin, 2003). We theoretically sampled one rich case-study in-depth, building upon the insights of persuasive single case-studies (Siggelkow, 2007), aiming to explore a recent phenomenon – the prominence of repeat engagement of PBFs in megaprojects – to build theory (Eisenhardt & Graebner, 2007). While many studies have analysed the involvement of PBFs in specific megaprojects as snap shots, the novel aspect of this research is to consider how such firms engage longitudinally in the process of capability development and learning from their involvement in successful megaprojects.

To achieve the overall aim, the study has examined a PBF with capabilities in civil engineering, and strategic consultancy in the built environment, that recently was recognised as the world leader company in programme management services. The company analysed is employee-owned, organized in business groups and develops its projects advising clients in the industrial sectors of water, transportation, environmental and nuclear, oil, gas and chemical, and industrial and urban environments. This PBF was purposely selected (Eisenhardt & Graebner, 2007) 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 global 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.

An extensive set of interviews was conducted across different hierarchical levels to explore various dimensions of the PBF capability development inspired by Langley's (1999) call for more studies combining theory and data over time. The consideration of numerous knowledgeable actors from different levels provides rich information from multiple angles within the organisation, enriching the case and mitigating the bias of "retrospective sensemaking by image-conscious informants", often associated with a small number of respondents (Eisenhardt & Graebner, 2007, p. 28). Interviews were conducted with senior megaproject leaders employed by the organisation, ensuring a balance of employees working at the headquarter and outside in megaprojects, where they were working client-side (often co-located) to deliver the megaproject. This strategy was purposely designed to capture the knowledge integration flowing from the megaprojects to the PBF, as well as the internal reconfigurations of the core structures as a reflection of new information.

An initial list of ten people was suggested by senior leaders of the firm, from which seven were successfully interviewed and further snowballing exercise was conducted, in which each practitioner provided up to three recommendations of further professionals. In the second stage, the career of each suggested practitioner was analysed via LinkedIn to verify the relevance of their contribution to the research. As a third step, the expanded social connections of the initial seven professionals and their recommendations were analysed. This exercise generated an extensive list of profiles from the firm's employees and created an understanding of the internal professional network. A final list was developed after the analysis of the career of all identified practitioners. In total, the empirical dataset consists of primary data represented by 87 interactions, 78 interviews and nine validation meetings with the senior industrial practitioner supporting the research;

as well as secondary data composed by auxiliary documents, both internal and external.

The interviews were conducted by two researchers over a one-hour slot organised with practitioners in several time zones around the world. The names and roles of the senior practitioners interviewed are not disclosed for confidentiality reasons, as their seniority and leadership positions are reflected in unique job titles, with significant potential for identification (e.g. Programme Director of specific projects; Regional and Global Director of function, Vice President). Interviews were framed following open-ended questions in an exploratory nature, aiming to reconstruct the organisational capabilities over time and unpack the corporate mechanisms to capture and disseminate knowledge, as presented in Appendix 1. The questions are both retrospective and in real time to shed light on the research problem (Alvesson and Sandberg, 2013), the understanding of how the firm is capturing the knowledge from multiple megaprojects, evolving over time, and codifying the learning gained from previous experiences into organisational capability. The organisational capability works as a knowledge base that is deployed across multiple megaprojects in different geographies.

Informed by the extant research on the PBF and project capabilities, the interviews enabled us to explore and develop new insights into how capability development occurs when a PBF engages in a series of megaprojects (Miles et al., 2014). The concept of vanguard projects (Davies & Brady, 2016) inspired the identification of key prominent megaprojects, which organise and influence the trajectory of the organisational capabilities. Following Gann and Salter (2000), the data were analysed to uncover the interconnectedness of two levels, the strategic level with ongoing business processes and the project level, the latter represented by the firm's involvement in multiple megaprojects. Building upon Davies and Brady's (2016) research, the data were analysed to examine the challenges of building capabilities to specific one-off megaprojects and the knowledge internalisation challenges at the corporate level. We charted the evolution of the firm through three stages of capability building, which allowed the longitudinal exploration: (i) within the project; (ii) project-to-project; and (iii) project-to-organisation. This strategy provided the framework to reveal the richness of the case and contributions of the research, exploring the challenges of organisations involved in multiple megaprojects over time.

4. Results

4.1. Evolution of major programme management capabilities

The PBF evolved to be a Megaproject-based Firm (MBF) after following a capability development journey of several decades that started with a vanguard megaproject (Davies & Brady, 2000). During the vanguard project the evolution of programme management capability was confined within the megaproject, being subsequently transferred from the vanguard project to another megaproject, and finally from the megaproject to the organisation for exploitation.

4.1.1. Programme management capabilities—Within the megaproject

The firm has developed engineering and programme management capabilities through significant engagement with the USA government, developing infrastructure projects across the country since the company was founded, most notably water projects in the 1960s. In the 1990s, the Rocky Flats Nuclear Weapons Production Facility was a particularly challenging project, considered by many interviewees (Appendix 2) as the first megaproject conducted by the firm, as illustrated by the following reflection.

"Rocky Flats was the first real example of the power of programme management for the company and I will tell you quite honestly for the whole of the industry. It was the only programme that I am aware of that was able to save [30] billion dollars and able to deliver what was it, [sixty] years early or something. And the fact is, that kind of metric sells itself. It is the thing that [the company] and that team are remembered for but it's also the thing that

identifies or gives identity to the power of programme management.”

This project was the largest environmental clean-up, responsible for the decontamination and decommissioning of a 6200-acre plutonium production facility. Rocky Flats was a site from the Department of Energy (DOE) to be cleaned up and was designated as a state wildlife refuge. The project was delivered in 10 years for USD 7.1 billion - an exceptional outcome because it was 60 years ahead of the schedule and around USD 30 billion under the original estimate by the government. Rocky Flats was a highly regarded project in the industry, winning the 2007 NOVA award for innovation and safety from the Construction Innovation Forum (CIF); 2006 Grand Award for Engineering Excellence from the American Council of Engineering Companies (AMEC); 2006 Project of the Year Award from the Project Management Institute (PMI).

4.1.2. Programme management capabilities—Megaproject to megaproject

After successfully delivering the Rocky Flats project in “*the most dangerous site in America*”, the firm has transferred the learning from the United States to its subsequent megaproject in the United Kingdom, the London 2012 Olympics. This was a challenging move as the new megaproject was embedded in a different continent with contrasting cultural and working behaviours. After gaining experience in Rocky Flats, key senior leaders were relocated to the UK, aiming to share their experiences, assemble 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 recognise that at the time of the Olympics, the UK construction context was in a unique position and contextually influenced by having experienced both significant failures and successes, in the cases of the Wembley Stadium and Heathrow Airport Terminal 5, respectively.

“We had the core management capability to get both jobs done. At Rocky we had to find all these domain specialists and security and other things, which then surprisingly the same issues were present at the Olympics, and we moved several of them to the Olympics, or they advised the Olympics team from there.”

The empirical evidence suggests that at the time of Rocky Flats and the beginning of the London 2012 Olympics, the knowledge was confined in the minds of a group of individuals and not widely spread in the firm, not being systematically embodied in its business processes. Therefore, although the company had a huge 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 programmes in the portfolio. The evidence (Appendix 3) suggests that when the capability is being created on a megaproject, the firm can achieve a faster responsiveness internalising and replicating the knowledge relying just on a few rich and high-profile programmes.

4.1.3. Programme management capabilities—Megaproject to organisation

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 includes capabilities such as tunnelling (e.g. developed from participation in Crossrail which were later being exploited in the Thames Tideway Tunnel project), programme controls, and risk management. The latter relate to the approach the firm 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. This point was exemplified by a senior manager who reflected on the risk of conducting innovative activities to gain new knowledge against the uncertainty of future markets that such knowledge might unlock.

“If someone says a project or bid is strategic for the company, I immediately understand that we are going to lose money on that bidding. If it is a one-off project that will open new doors and markets, I get very anxious about it, because you don’t know the market and you are going to make mistakes. If you want to do that, go as a minority party, and rely on someone who has experience, learn from that and apply afterwards. Some projects give you the exposure and lead to another if you do a good job”.

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 an innovation strategy (first developed at Crossrail) that is being copied, adapted, and tailored to other major programmes. 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 the firm include both operational and strategic capabilities, in a process of capabilities integration, some from within the company and others complementary from the external market.

The firm is currently exploiting the London 2012 capabilities in a business-led perspective, where packages (slices or bundles) of the capabilities developed for the Olympics are being reconfigured internally and implemented in 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, as a result of deliberate 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 organisation, mapping the transition stages from exploratory learning in vanguard projects to exploitation in repeatable solutions to projects. As an illustration, the firm 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 subsequent project, as illustrated by reflections in Appendix 4 and articulations in the discussion section. In each case the specific role has varied in some ways but the firm 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 organisation.

4.2. Programme management capabilities—Organisation to megaprojects

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

4.2.1. Transfer of capability through individuals vs central initiatives

The future organisational capability required by the firm to deliver megaprojects is partially embedded in an individual’s tacit knowledge formed over years by participating in the delivery of projects. Individuals are responsible for transmitting the knowledge to the organisation, also known as knowledge brokers that help to institutionalise it, creating a sense of property and ownership of that knowledge, acting as carriers of key pieces to create an organisational memory and culture over time. Therefore, the importance of individuals to transfer capabilities across megaprojects creates the risk of dependence and emphasises the necessity for systematic central initiatives to disseminate the knowledge. This tension relates to the disconnection between programmes and the portfolio and the necessity of having constant loops in

this interface in order to evaluate the practices in each megaproject.

In this case, it may also be possible to codify the knowledge and replicate it in other large-scale projects across the portfolio through the reutilisation 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 organisations, which is described as the company's written intellectual capital encompassing internal systems, tools and procedures. One challenge is to maintain and update this central system 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 programmes, it is critical to shorten this loop of knowledge internalization creating the dedicated role of *knowledge integrator and disseminator*, in order to enable responsiveness to the organisation and fully exploit the benefits of this knowledge.

Knowledge is codified, integrated and transferred at the bidding stage in order to develop a winning solution, leveraging previous experiences such as best practices, the reputation of the projects, and the calibre of the people that can be relocated. Strategically, the company provides exposure to people on major programmes, enhances their CVs and puts their names in the next bid to win new programmes. The bid for Thames Tideway Tunnel was built based on the learning from the Olympics and other complex tunnel projects across the world. In the ideal case the firm would appoint a relevant programme director to share lessons on the bid effort, who would then proceed to lead the project if the contract is awarded, however there are temporalities affecting such decisions, as described by the following reflection.

“The programme director is appointed at different stages, there is no rule. Once the bid is identified, one of the programme directors start to act as the “outside” sales manager, start to liaise with the client, he would lead the bidding team and if awarded he will direct the delivery team, that’s the ideal scenario. Unfortunately, in the majority of times this is not what happens, you have a disconnection between when one project ends and another starts, and you need to make that person billable”.

Another feature of knowledge movement is regarding the transition of experienced programme directors to the corporate level and after some time back to a megaproject. In order to be able to manage a very complex megaproject full of interfaces, it might be beneficial to senior leaders to draw upon the knowledge from the corporate level of how to manage a business. However, after moving to more senior management in the corporate chain, their personal choice often is to leave and go back to leading a megaproject, where the real excitement is, as illustrated by the comment below.

“The top of the tree in this organisation is not in a corporate role but managing a big programme”.

For this profile of senior experienced executives it is not about going up the corporate hierarchy or making money, but working close with the client and aligning with their personal objectives, *“it is about a reason to get out of the bed in the morning”*. In particular, these senior managers value the megaproject environment and the connections with project teams, creative and entrepreneurial initiatives, and the leadership challenge.

4.2.2. Soft skills as a key competitive advantage

The current environment of professional services in engineering and management is characterised by a phenomenon of commoditisation, where every company advertises that it can provide all the services of the market and is an expert in each one of them. This approach can be verified by the website of those companies, where it is common to see their services being offered through expressions such as *“an end-to-end solution”* and *“integrated platform”*. In this scenario, professional service companies are keen to develop trust and positive relationships with clients to build a reputation of *“the place to go”* for a particular product or service. This reputation seems to be a key part of the business model and is analogous to the open platform created by technology companies,

once it creates a strong identity, has the power to attract new customers and is very difficult to replicate by competitors in the short and medium term. Therefore, there is no need to protect your knowledge and capabilities, but rather your *“brand”*, as one manager stated as follows:

“You need to protect your personal brand [expert and collaborative], so just give everything away that you have got. Don’t protect your knowledge, give books, seminars, papers and so on”.

The key competitive advantage perceived by the market is not associated with the hard skills, as every major company will have virtually the same systems, tools and procedures for programme management. The key argument is that individuals and firms (of the same level) would be technically competent with no significant distinctions, with the competing firms just bundling, presenting and selling the solution differently, as reflected by one manager:

“It is really difficult to reuse things in other projects. We have a central and well-defined systems and procedures in place, for programme management, where the intellectual capital is written, if you are a client, we will give to you. Everybody has the same cost control, change management systems, it is just how you package them to sell, this is not your Intellectual Property. It is no difference than it was 20 years back, it is more paperless. The innovation has changed a bit, people are more willing to talk about crazy ideas”.

In this context, the competitive advantage is strongly connected with the soft skills, where the relationship between client and development/delivery partner is emphasised. Clients are increasingly assessing the behaviour of key suppliers, weighting the relational ingredient as a major component in the decision-making process, particularly in more mature markets. In a scenario where the technical capability is increasingly not a winning factor, clients are considering the type of organisation they will partner with and the people they will interact with in the office for an extended horizon of time.

In light of this fact, it is not a matter if organisation A or B can deliver the project, 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. Companies are adapting given their understanding about the 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 organisation/partner, described by many as listeners before doers, is a key ingredient of the company's competitive advantage. The firm's spirit of collaboration and collegiality is something unique and it is possible to track this organisational capability to the individual level by observing these principles and values on people's behaviour every day. Although the company is known for its external collaborative behaviour 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 needs to ask the right questions to get the answers, as the other very skilled person on the line from a distant geography needs to have its knowledge triggered by questions. The knowing of the right questions will trigger the transfer of the embedded knowledge through a variety of examples and explanations, as reflected by a senior manager with the following comment:

“You can’t write it down the experience. You don’t know what you know until you have to explain to someone (that’s the importance of the questions). You can’t write it down because some bits of it aren’t articulable, knowledge as a noun and knowing as a verb”.

5. Discussion

5.1. Contributions to theory

This research is theoretically informed by the capability literature (Brady & Davies, 2004; Davies & Brady, 2016; Leiringer & Zhang, 2021), contributing to advance the debate about a recent phenomenon of firms involved in multiple megaprojects around the world. We contribute to the PBF literature by identifying the dynamics of capability

building in firms delivering a series of megaprojects over time, which we label the Megaproject-based Firm (MBF). Whereas extant research on the PBF showed how firms gradually standardise their offerings and replicate a set of capabilities as they move from a vanguard project into a new line of business (Brady & Davies, 2004; Davies & Brady, 2016; Gann & Salter, 2000; Hobday, 2000; Leiringer & Zhang, 2021; Söderlund & Tell, 2009; Whitley, 2006), the case study presented in this paper identifies the challenges faced by firms when attempting to identify and replicate elements from each megaproject. Therefore, the research contributes to the literature by identifying how a new type of organisation – the MBF – identifies, develops and reconfigures its resources, routines and capabilities to deliver a portfolio of megaprojects over many years.

The research also considers the interdependencies between the temporary and permanent spaces (Frederiksen et al., 2021; Grabher, 2002; Sahlin-Andersson & Söderholm, 2002), where the MBF operates and creates value with clients and multiple partners. The relationship between temporary and permanent core is unfolded by reconceptualising one permanent firm that is involved in multiple sophisticated temporary spaces, the megaprojects. An MBF faces opportunities for learning from multiple megaprojects delivered with clients outside the boundaries of the firm.

The capabilities of the MBF in our study were developed over time based on engagements with several key megaprojects and deliberate strategies to develop capabilities and a reputational asset and brand in programme management. The firm started out by redeploying organisational resources and capabilities when it strategically engaged in the Rocky Flats vanguard project, which is later complemented and reinforced by the focus on developing the specific human resources and relational capabilities needed to deliver the programme (e.g. collaborative, flexible). This transition from existing to new resources and capabilities enhanced the firm's market position and brand for programme management. There is a combination of value creation which is partly exogenous (with managers co-creating solutions with clients in megaprojects) and endogenous (the structures of the firm to absorb such value and exploit across the portfolio).

Our research reveals how a PBF evolves to MBF and develops programme management capabilities (Arto et al., 2009; Pellegrinelli et al., 2007) over time to address increasingly complex megaprojects (Denicol et al., 2020). Vanguard projects (Brady & Davies, 2004) are a key concept in framing the evolution of capabilities in the MBF, as evidenced by our findings. The involvement in specific projects might provide the organisational platform to learn, internalise and contribute to the process of capability building within the firm (Davies & Brady, 2016). Therefore, the organisational capability in question is constantly changing and evolving throughout the life cycle of multiple megaprojects. The internal loops of knowledge provide the MBF with the opportunity to reflect on the practices being used by themselves, clients and competitors in current megaprojects, and make strategic decisions for internalising such advancements to their own offerings. The process is iterative and necessarily implies recombination with the existing capabilities of the MBF, aiming to arrive at new solutions to be deployed across several markets. The capabilities being developed by the MBF in our study include both operational and strategic ones, through an integration process whereby capabilities from within the company are complemented by the external market. Since there are capabilities being utilised at the strategic level across the MBF (e.g. regional, global level) for decisions such as resource allocation and prioritization of major programmes, this research could be expanded through an extensive analysis of the portfolio management literature.

It is acknowledged that learning from and across projects is difficult, particularly due to the lack of structure inherent from the flexible arrangements that project structures put in place to deliver successfully (Söderlund & Tell, 2009). Firms have business processes at the core that need to be developed in order to maintain the individual learning and services going in the multiple temporary project spaces (Gann & Salter,

2000). Therefore, the coupling and decoupling of a megaproject with the permanent organisation is particularly challenging, where the multiple interface points might provide opportunities to reveal in detail the processes and capability dynamics (Sahlin-Andersson & Söderholm, 2002). In this context, the practice of portfolio management by the MBF is particularly prominent to inform this debate, with potential opportunities to insert lessons in current and future megaprojects across the portfolio (Martinsuo, 2013). There are multiple integrations of knowledge (Pemsel & Müller, 2012) and efforts of capability building, as there is a base of megaprojects inserted into a portfolio of current services, and new ones being added progressively as contracts are awarded.

Rocky Flats represented a vanguard project and an opportunity for exploratory learning for the MBF. During this megaproject, the lessons learned and knowledge sharing activities were confined within the project (Brady & Davies, 2004), which was later transferred to the UK (project-to-project) to enable the delivery of the London 2012 Olympics. The learning within and between these megaprojects (Martinsuo et al., 2017; Turkulainen et al., 2015) has enabled the company to develop a set of capabilities which can be applied to deliver megaprojects in several markets (Lehtinen et al., 2019). These capabilities cover both hard and soft skills which are translated into technical and managerial areas in programme management (Brady et al., 2005). As a service-oriented firm, MBFs are reliant on their human resources to work closely with the client. Skilled personnel as a resource are critical to enabling the firm's business model of capturing value through sequential engagement in megaprojects at client side. In a context of commoditisation of knowledge in professional service firms, the most valuable asset is the intangible rather than tangible resources (Barney, 1991).

London 2012 Olympics has a worldwide reputation for successful megaproject management practices, particularly in the programme management space (Davies & Mackenzie, 2014; Grabher & Thiel, 2015). The firm used the learning gained from London Olympics (project to organisation) to build a global brand and reputation for major programme management services. The programme management success of this iconic megaproject was used and disseminated to improve the delivery of subsequent megaprojects around the world. The in-depth case study provided the opportunity to explore the evolution of a MBF's involvement as development and delivery partner in several megaprojects, as illustrated by Figure 1. The approach considered actions, mechanisms and events of learning from projects to improve the firm's performance, looking at the current megaprojects and retrospectively to understand how capabilities were assembled and deployed, and what was the impact on the current and future projects.

The delivery partner concept successfully implemented at London Olympics was used as a model and adapted to the needs of clients around the world. The upfront design of the appropriate roles and responsibilities between clients and delivery partners is a key element of successful programme management. Delivery partners are often comfortable with assuming more risks, as long as they have the freedom to perform, maximising their programme management capability through talented individuals and capable teams. The inter-organisational configurations vary according to integration levels, from two separate organisations with more delivery responsibilities allocated to the delivery partner (Megaproject 1), towards a more integrated relationship with clients often working collocated (Megaproject 2), until a single organisation with clients and delivery partners working as a fully integrated team (Megaproject 3).

Project capabilities has been used as a term to label the organisational ability to deliver projects, which provides a broad framework for several capabilities, that might be used to address specific purposes (e.g. improve control, coordination, reduce uncertainty) (Brady & Davies, 2004; Davies & Brady, 2016). Leiringer and Zhang (2021) found a lack of conceptual coherence when reviewing the capability literature in the context of project organising, where the constructs are often redefined by several authors over time, inspired by their different background and disciplines. Although the plurality is welcomed to enrich the debate

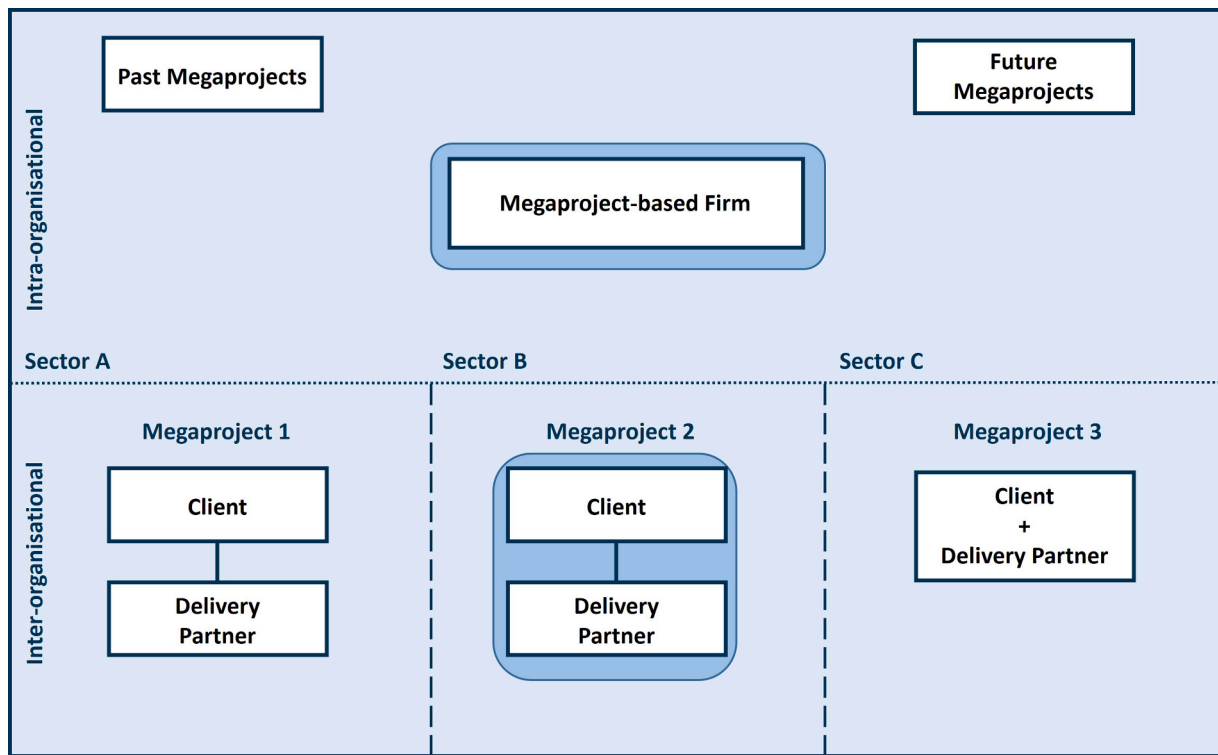


Fig. 1. The Megaproject-based Firm (MBF).

from different angles and perspectives, the conclusions of Leiringer and Zhang (2021) suggest that the field is growing laterally (breadth) and would strongly benefit from conceptual clarity to accumulate knowledge and move forward (depth). This seems to be an important step, otherwise it might be challenging to achieve convergence to significantly compare and debate the same levels, categories, and orders across different studies (Denicol, 2022).

5.2. Recommendations to practice

Multiple firms organised across different levels in the inter-organisational system inform the overall performance of the megaproject, which is by definition collectively created and delivered (Davies & Mackenzie, 2014; Denicol et al., 2021; Gil, 2009). Therefore, the performance at project level needs to have a client, an entity that is responsible/accountable for achieving the performance targets of the entire endeavour (Denicol et al., 2020). This is of paramount importance as multiple parties will have their own interests, individuals will be seconded to the projects but will be loyal to the permanent firm that employs them, and the networks of relationships between firms and individuals are transient, often guided by the specific capabilities of each organisation and the lifecycle of megaprojects. This seems relevant to understand the dynamics of building programme management capabilities in MBFs, which will be engaged in several projects guided by performance metrics of the client, but equally developing their offerings to perform well as a corporate entity delivering programme management services across the regional/global portfolio.

There is a movement away from the traditional project management model, where the philosophy is to define all the elements up-front in a very optimistic view of the world, anticipating plans to mitigate and eliminate all the risks. This model is well-known in construction and characterised by clear boundaries between members of the project, hierarchical culture and adversarial relationships, usually associated with industrial projects (Merrow, 2011). In a post-industrial projects

environment where projects are exponentially breaking records of scale, complexity and budget, it is emerging a new model where flexibility, adaptability, and the recognition of the unknown is the one perceived as more sensible given the proportion of the endeavour. The new model provides an avenue to a more efficient journey throughout the life cycle of megaprojects, with clients incorporating more value from the firms assembled to deliver the megaproject.

The MBFs need to recognise the dilemma between the central corporation and the megaprojects being delivered outside the boundaries of the firm, as well as the necessity of creating and maintaining a balance at different levels: project, programme, and portfolio. All levels are constantly evolving and influencing each other, changing the organisation as a whole towards the megaprojects being delivered, following the logic embedded in the business model of PBFs. In this context, there is a managerial opportunity to observe the organisation through a systemic lens, consolidate at the core the learning that is ongoing at the frontiers and make strategic decisions to create balance within programmes and across the portfolio.

The capability 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 the firm is a client-centric organisation, it can adapt and tailor its framework to different types of clients, from those that are naive and want a day-to-day or micro management to those that are mature enough to tell *what* they want and by *when*, empowering the delivery partner to do the *how*, which is what they are being hired to do and can add value. 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 (Denicol et al., 2021). If the client does not empower the partner to deliver, there is a large opportunity cost being lost for the full exploitation of the key competitive advantage of the organisation that is acting as development or delivery partner.

A 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 the major programme. This practice is observed in most of the recent megaprojects and draws upon the fact that there is a lot of intellectual capital during the bidding and the joint venture formation. It is a strategic decision to maintain those individuals providing continuity in order to build from the level already achieved. However, considering the length of these endeavours there is a significant potential for continuous knowledge integration throughout the project life cycle. Firms investing in the dimensions of flexibility, adaptability, and pace, might be well positioned to deliver their programme management capabilities and successfully grow in rapidly changing and increasingly uncertain markets.

6. Conclusions

In this research, we have considered how recent developments in the understanding of organisational capabilities may help us to illuminate how PBF involved in complex projects learn, acquire, integrate, and apply new knowledge. We introduce the concept of the MBF, drawing upon the examination of a PBF with capabilities in consultancy, that recently was recognised as the world leading company in programme management services (Arto et al., 2009; Martinsuo & Hoverfält, 2018). The megaprojects outside the boundaries of the firm are conceptualized as strategic temporary inter-organisational programmes (Jones & Lichtenstein, 2008) that foster transformations and reconfigurations of the permanent, intra-organisational structures of the MBF. There might be multiple organisational configurations across the MBF, each megaproject could be understood/conceptualised as a unique temporary form of organising. In this logic, specific characteristics would be present in the temporary interface (MBF vs client), but always relating to and supported by the same core structure of the firm.

The management of multiple megaprojects outside the core of the MBF, driven by knowledge being created outside the boundaries of the firm contribute to drive the strategies of the central firm. Such strategies will in turn be applied to capture future projects and manage current and future projects outside the central organisation. Here there are two ongoing and promising spaces, first the learning happening in inter-organisational projects outside the boundaries of the firm (i.e. the multiple megaprojects), and second, the diffusion of this knowledge within the permanent organisation, therefore affecting and changing the design of its intra-organisational structures and capabilities.

Clients are increasingly engaging with their development and delivery partners, removing boundaries to work collaboratively in a clear process of absorbing the knowledge to become more capable organisations. In this context, the MBF leverages its client-centric approach and sells its integrative, flexible, adaptive, and collaborative approach to develop together a tailored solution for the client's requirements.

Our findings suggest that an important capability is the relationship with the client, which might be built within and outside the boundaries of the firm, in collaboration with clients over time and across megaprojects. This relational aspect is often neglected in light of more technical capabilities of the supplier, however in a world where there is increasing commoditisation of knowledge, the way in which such capabilities are delivered and operationalised by the firm (often collocated and collaboratively with clients), is being perceived as critical for enabling successful programmes. The high relational awareness of MBFs

allows organisations to learn more proactively from the multiple organisations involved in shaping and delivering the megaproject. Therefore, organisations that can demonstrate high degrees of flexibility and adaptability might be well placed to capture more value from the rich knowledge-intensive environment in which they are embedded.

Reputation is important in programme management, particularly in challenges as complex as megaprojects. However, such reputation was traditionally connected with the *hard* skills of the project profession, whilst our findings suggest that one of the most important reputational ingredients in the programme management space is connected with the *soft* and relational skills of collaborating and delivering *with* clients, not *for* clients. Therefore, we denote significant importance to the interpersonal skills of programme managers, that are often working collocated with clients and implementing the formal programme management capability of the firm to deliver the megaproject.

Our findings are guided by an extensive number of interviews on a purposely selected case-study, which provided a rich understanding of the firm and the dynamics in several megaprojects. Although our strategy for interviews was undertaken across multiple levels of the firm, research with single-case studies is known to have limited generalizability of findings. The processes of how the analysed firm strategically leveraged capabilities over time might be used as inspiration for future research on the MBF. However, we acknowledge that other firms might have different trajectories influenced by the institutional environment, market structure, and other factors. The exploration of multiple cases of firms building programme management capability to deliver megaprojects is a promising avenue for future research.

We encourage future researchers to explore the dynamics between clients and suppliers in megaprojects, identifying the competing interests and priorities of each organisation in the process of capability building. Clients will naturally be inclined and incentivised to put together different capabilities from multiple organisations, designing and creating an inter-organisational map informed by the best player to deliver specific capabilities. Megaproject clients are often operating in a temporary domain, where many client entities are formed to deliver one single project (Denicol et al., 2021), which provides an interesting empirical setting to investigate the balance of in-house vs outsourced capabilities (internal vs external). Suppliers are operating in a different condition, where firms often draw upon their internal capabilities from the permanent organisation to inform the structure and composition of the temporary capabilities assembled to deliver according to the client's brief and requirements. As an interesting evolution, suppliers might be asked to act as clients in certain instances of integrated project delivery, working with clients or empowered by them, which configures a promising research avenue.

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Appendix 1. Interview questions

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1. Briefly describe your roles and responsibilities on the megaprojects that you have participated.
 2. Describe what divisions within the company were involved/responsible for each megaproject.
 3. How was the relationship with the client and its client organisation?
 4. What aspects worked well, and which did not work in the management of those interfaces?
 5. What capability should be developed to address those issues and by whom?
 6. What are the strategic lessons to be learnt from those projects (e.g. what had worked and what did not work in the front-end of the project)?
 7. In what areas do you think it is most important to capture experiences and learning that has taken place within the megaprojects, so as to be available to other programmes?
 8. What strategic efforts has the firm made to capture the lessons and transfer it from one megaproject to: (i) Other megaprojects; and (ii) Divisions within the firm.
 9. What previous experiences and learning have been important to you in the planning and execution of the megaprojects?
 10. What aspects of these megaprojects represented exceptional, extraordinary, or unique challenges?
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Appendix 2. Examples of programme management capabilities within the project

Programme management capabilities – Within the megaproject: Rocky Flats

Representative quotes

The role of a programme manager is very different to a project manager. Because a programme manager needs to be very savvy about the environment they're operating in, the people aspects of what they're operating in because the whole political, particularly if they are of scale. The politics of that, you can't be ignorant of that. You cannot come in on a major programme and ignore that. You can have very successful large project managers who don't succeed as programme manager because they don't have the antenna and skill set to understand the public visibility, the scale, the internal issues the client has. They require a whole different type of manoeuvring, then a traditional engineering project. We put it in place stakeholder management approaches, benefits management and remuneration approaches. How we needed to organise that whole endeavour really required us to start from a clean slate.

We had to work and put in place a contract. And then once the contract was in place, actually proving that we actually were achieving progress against the way that contract worked we actually had to go align, to align the team to determine what was going to be deemed successful completion of the contract.

They [senior leaders in Rocky Flats] would tell you the contract was as important a tool for them to get the job done, with their team, as it was to us. It allowed them to tell their team who kept pushing back, saying, "Well we want to get involved in this and that." No, the contract says this, you have to deliver this.

When we could see how we needed to close the facility we actually put in place... we proposed a very different structure and leadership organisation from how you actually ran the facility on a day-to-day basis. And that was the organisational structure, a work breakdown structure, base line schedule, all the milestones, everything. We actually conceived a structure for the closure project itself.

What we did do, though, that was really important was that the executive leadership of our project team actually went through three transitions in that five-year period of time. Because who was needed to be the point person, the project director for us establishing the vision, working with the Department of Energy, working with congress to actually conceive that this was an opportunity that everybody was willing to get behind, that person was a very different person from a skill set and strength perspective. And once that was all in place and the contract was signed, now we actually had to go to work and we actually had to make real progress against this very definitive schedule we put in place. We needed a very different kind of executive leader during that, and so we transitioned from one person to another.

Appendix 3. Examples of programme management capabilities project to project

Programme management capabilities – Megaproject to megaproject: Rocky Flats to London 2012 Olympics

Representative quotes

It became very much the same, so the two projects started out quite different but at Rocky Flats, we had more statutory authority in our role there than we did on the Olympics. What we did a big issue in these contracts when you look at oil projects and others that have overruns, it comes down to how do you allocate roles and responsibilities between the lead contractor, whatever you call them, the delivery partner and the client.

What we did on both projects is we consciously took risks, we transferred risks to us, to give us the freedom to perform. To give us the authority we needed to perform, but showing that if we didn't perform, we had sufficient risk, that they could go to sleep at night saying, "I think they're really good at trying to do this right because they are going to hurt if they don't".

But in both cases the key ingredient for success in my view was the contract that then defined the responsibility and typically what happens is the lawyers write the clients contract which basically puts 100% of the burden on the delivery partner and none on the client. And these contracts are rewritten to be balanced, that the delivery partner is agreeing to take all these unusual risks for a reward but as part of the bargain the client has to deliver all this stuff at this time, or the deals off. And both clients got super busy delivering their stuff and it was very helpful.

London 2012 I think was a big mile marker for us. Especially with the delivery partner element. The visibility and the success of London 2012 was again the thing that was the mile marker for us. It's the thing that characterised an ongoing development and change within our programme management offering and within industry as a whole.

You've got to have iconic programmes to market this kind of investment to our clients. You have to have a solid framework that is adaptable but yet consistent and you have to develop our programme management human capacity.

It's a unique time when you're starting up a major project or programme and part of what skills are needed very specifically is related to... It is a relationship management, it is engaging with stakeholders, it is really the person who understands governance and actually setting up governance. And it's also a person who understands, how do you make sure everybody keeps the vision for what we're trying to achieve in front of us and putting in place governance that respects that. And then they have to have at their disposal their deputies. Their next line of leadership has to be fantastic people in terms of getting an organisation together, getting everybody aligned and being able to actually make progress during that period of time. Because they're going to have to be so engaged in connecting dots for this programme team appropriately but also engaging clients, stakeholders, politicians, etc, that need to be engaged.

Appendix 4. Examples of programme management capabilities – project to organisation

Programme management capabilities – Megaproject to organisation

Representative quotes

A programme management orientation, which is essentially systems orientation, is required. And so for us, as a company, the better we are at appreciating and understanding that the solutions that we're going to bring are going to be to more complex problems. That we're going to have to integrate, be good integrating the right kind of people with very different kind of skills or perspectives together to be able to go do. That's what we have to place the bet on, and the fun part is.

We as a company have to figure out a way to be able to transport knowledge, to be able to move that knowledge from place to place and from programme to programme and from individual to individual across generations. So that we continue to develop our programme management capability but not lose any of the vitality or learning that we had in previous generations of programme managers and programme directors. But I got to tell you that I have absolutely come to the conclusion that programme management, good programme management, is not about the systems and the tools. That is probably the most visible the most purchasable component of programme management. It unfortunately is often the one that I think requests for proposals and other client documents try and focus on because it's something that you can specify easily. It is easily defined. What I really think sits at the heart of good programme management is the understanding that programme management is about people.

Simply having a set of tools or standards or systems that we implement everywhere doesn't capture the characteristics, the personal characteristics of each client and of the teams that those clients put in place. And yet the thing that in my opinion make a programme successful or makes it fail is the ability to cause those people, to cause those teams to do the right thing on the programme. So what I guess what I'm really saying is we need a suitcase. A kit of parts that we can bring in with us to every programme, which has a good scheduling system, it's got a good risk management system and it's got a good document management system and it's got a good collaboration system and it's got a good cost management system and it's... those are all critical. But it's what sits behind it, the people that drive it that invariably make those systems successful.

It's also educating the delivery partner staff that, okay there are certain things the client cannot delegate, you know, there are a legal signatory to certain things and they're going to have to play a big role in PR even if we've got a good PR team. They're going to have to play political role, they're going to have to play some sort of stakeholder role, they're going to have to do some licensing and some regulatory activities. How do we help them understand that and equip themselves for it and know the schedule and then know the steps that are going to be required for them to meet the schedule? Also its training the client on their role.

I do think one of our key differentiators is how we work with our clients. It's something that is sometimes difficult to convey on paper. We are not going to come in and say this is [our] way, this is how it's going to be done, and that's it. It really is that collaboration of how we are going to tailor this programme to their needs. That's an example of how we demonstrate that we are collaborative with them.

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