

The role of Project Management Office (PMO) in stimulating innovation in projects initiated by owner and operator organizations

Abstract

This article explores the extent to which innovations are driven by the Project Management Office (PMO) - an internal unit within owner and operator organizations that is responsible for overall project assurance and control. Semi-structured interviews were conducted with organizational members of Transport for London (TfL) – a public transport owner and operator organization and a key stakeholder in the UK infrastructure sector. This was combined with the analysis of four project assurance reviews initiated and delivered by TfL. The findings demonstrate that PMO provides opportunities for building and enhancing innovative capabilities of the owner and operator organization.

Keywords: innovation; innovation capabilities; owner and operator organization; project lifecycle; Project Management Office (PMO)

Introduction

It is increasingly emphasized that owner and operator organizations play an important role in stimulating innovation in projects (e.g. Orstavik, Dainty, & Abbott, 2015). In this article we define innovation as “the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order” (Van de Ven, 1986, p. 590). Owner and operator organizations are accountable for the physical assets and their operation, bringing financial packages together and initiating projects (Winch, 2014; Winch & Leiringer, 2016; Zerjav, Edkins, & Davies, 2018). However, we still know little about the role of Project Management Office (PMO) within owner and operator organizations in driving innovation opportunities in projects (Too & Weaver, 2014). PMO is seen itself as an organizational innovation (Hobbs, Aubry, & Thuillier, 2008), and there is an emerging research

into the key role of PMOs in the management of innovation projects (Artto, Kulvik, Poskela, & Turkulainen, 2011). The research question that this study aims to answer is: What are the key roles of PMOs in stimulating innovation in projects initiated by owner and operator organizations? By answering this question, the research study aims to contribute to the existing project management literature by exploring the extent to which innovation in projects is encouraged through the specialized integrated arrangements of the PMO – an internal unit within owner and operator organization that is responsible for overall project assurance and control.

The remainder of the article is structured as follows. Initially, the relevant literature on owner and operator organizations in driving innovation in projects is critically reviewed. This is followed by the discussion on leading innovation throughout the project lifecycle, from the strategic front-end to the operational back-end. The roles of PMOs are outlined in stimulating innovation throughout project lifecycle. The empirical findings derived from the semi-structured interviews and project assurance reviews are then presented and discussed against the reviewed literature. The summary outlines the key points, acknowledges the limitations of the research study and suggests future research directions.

Owner and operator organizations driving innovation

It is commonly understood that innovations are driven by owner and operator organizations which have a direct relationship with customers and a strong interest in improving performance for those customers (Orstavik et al., 2015; Winch, 2014). By definition, capable owners should have innovative capabilities to drive and sustain innovations (Haugbølle, Forman, & Bougrain, 2009; Winch & Leiringer, 2016). The early work by Gann and Salter (2000) state that the owner wields significant influence over the supply chain to drive innovation. The owner's selected procurement and payment route can significantly affect innovation activity, for example, the use of fixed-priced contracts transfers risk to the contractor (Eriksson, 2011; Lim & Ofori,

2007). This results in an increased focus on output control to reduce uncertainty. Risk and uncertainty are often identified as one of the main barriers to innovation in projects. Cameron and Green (2012) argue that uncertainty within an organization can cause fear, instability, anxiety and a sense of loss of control. Sponsors, project owners may be risk-averse and do not seek innovation due to the increased risk of uncertainty and project failure (Davies, MacAulay, DeBarro, & Thurston, 2014). In contrast, innovation literature identifies flexibility, an appetite for risk, organizational culture of exploration, flexible governance system, collaboration as key 'ingredients' for innovation to thrive (e.g. Blindenbach-Driessen & Van den End, 2006; Liu, Wang, Skibniewski, He, & Hang, 2014; Lenfle, & Lock, 2010; Wan, Ong, & Lee, 2005; Watson, 2011). Project control, assurance and management systems employed by owner and operator organizations used to achieve delivery of projects on time, cost and quality may stifle the very necessary characteristics for innovation to occur (Keegan & Turner, 2002). Germünden, Lehner and Kock (2018) explore how firms (structures, people, and values) organize their innovation function by means of projects, programs and portfolios of projects. They argue that perceived organizational support of project managers is positively influenced by formalized processes for projects and portfolios, caretaking PMO and a visible engagement of senior management in a project-oriented organization.

Many organizations have recognized the need for a PMO to achieve project management oversight, control and support. The main purpose for an organization establishing a PMO is to improve the performance of its projects. Some of the common service functions of PMOs include developing project management methodologies, assisting management of project strategy, establishing project management oversight, facilitating innovation and knowledge management, leveraging previous solutions, sharing best practices, enforcing the governance of projects, adapt and integrate business interested (Hill, 2004). Yet, we still lack

a detailed understanding of the roles of PMOs in driving and facilitating innovation in the context of owner and operator organizations which initiate projects.

PMOs: The roles of integrator and promoter for innovation

The vast majority of the literature on PMOs suggests that the role of a PMO is to support, coordinate and control of project-related activities. According to Dai and Wells (2004) PMO is an organizational entity or unit established throughout the organization in implementing project management principles, practices, methodologies, tools and techniques. Hobbs et al. (2008) investigate the creation and the reconfiguration of PMOs as an organizational innovation. Pemsel and Wiewiora (2013) view a PMO as a formal layer of control between top management and project management within a project-based organization that is an institutionalization of governance strategy; they see the PMO as a knowledge broker. Artto et al. (2011) conceptualize the PMO more broadly as an integrative arrangement than a specialized project-based organizational unit that may include facilitators, innovation groups, innovation processes and/or management and innovation systems. According to Turner and Lee-Kelley (2012) PMOs are used in project-based organizations to develop, maintain and institutionalize project management competencies. In their study, the ways PMO managers balanced exploration (e.g. risk taking, flexibility, innovation, informality) and exploitation (e.g. selection, refinement, execution, formality) are demonstrated. Furthermore, the PMO guides and enriches organizational project management maturity and manages training and education aligned to organizational objectives (Too & Weaver, 2014). The PMO has direct links to the critical stages of a project lifecycle by undertaking evaluations and assessments prior to allowing the project to proceed.

The research on the use of the PMO as a driver, diffuser and integrator of innovation in the context of owner and operator organizations is limited (e.g. Aubry, Hobbs, & Thuillier, 2007, 2008; Hobbs et al., 2008). Liu et al. (2014) state that construction innovation requires

collaboration between the interconnected boundaries of a project. This suggests a need for an internal organizational synergizing force which can be in the form of the PMO. The PMO is typically seen as an organizational unit used to integrate inter-organizational structures, especially between leadership and the project due to the existing lines of reporting channels (Artto et al., 2011). Bredillet, Tywoniak and Tootoonchy (2018) view the PMO as an organizational innovation initiated to assist owner and operator organizations in better managing and coordinating portfolio of projects. They establish a conceptual process model where portfolio management is conceptualized as a collection of routines forming an organizational capability; the PMO is conceptualized as an organizational meta-artefact, and organizational sub-system designed to provide a solution to a problem. However, their research falls short in addressing the interplay between routines and change and innovation in PMOs.

The PMO can be reconfigured as a governance and innovative system to deliver the capabilities required for strategy materialization and project success (Karkuly, 2007; do Valle, da Silvera e Silvia, & Soares, 2008). The transition from corporate to project strategy is communicated through organizational structures, cascading down from corporate planning, through enterprise levels into portfolio, programme and project (Jamieson & Morris, 2004). Furthermore, Artto et al. (2011) argue that the PMO should adopt open and flexible management systems based on increased interaction and personalization to achieve the necessary capabilities for driving and supporting innovation. Collating and sharing lessons learned through knowledge management structures is an internal organizational activity managed by the PMO (Kapsali, 2011). There is a case for the PMO to be utilized as a bridge to diffuse knowledge with the purpose of driving and promoting innovation (Aubry, Hobbs, Müller, & Blomquist, 2010). Knowledge management is critical for the PMO to succeed in diffusing innovation and is also an important component of organizational ambidexterity (March, 1991; Pemsal & Wiewiora, 2013; Turner & Lee-Kelley, 2012;). There is also research

identifying the brokering role of the PMO and its respective functions (e.g. Aubry et al., 2010; Desouza & Evaristo, 2006; Julian, 2008). Pemsel and Wiewiora (2013) suggest that the PMO knowledge management structure must be aligned to the project manager's nature, need and expectations. Turner et al. (2014) identified the importance of implementing a project knowledge strategy at the front-end to enable exploration and exploitation throughout project lifecycle. In summary, PMOs are identified as important integrative arrangement for project and innovation management, yet there remains a lack of understanding the ways innovation is stimulated by the PMO throughout the project lifecycle.

Leading innovation throughout a project lifecycle

It is commonly recognized that the level of uncertainty is high at the front-end of a project due to limited information available; as a project moves on, uncertainty reduces, as more information becomes available (Winch, 2010). It is increasingly emphasized that innovation at the front-end of projects helps to reduce uncertainty (Davies, Dodgson, & Gann, 2017). Furthermore, the front-end of a project shapes the innovation and value co-creation (Arto, Ahola, & Vartiainen, 2016). As stated by Matinheikki, Arto, Peltokorpi and Rajala (2016, p. 1228) "innovation is in the core of value creation". Kock, Heising and Gemünden (2016) cite the need of an organizational mind-set being open to taking risks, enabling project practitioners exploiting uncertainty by seeking innovative solutions. The research into 'windows of opportunity' identifies the front-end as an influential stage of the project lifecycle (Hamilton, 2010). Loosemore (2015) further argues that innovation is a dynamic process and identifies the 'encouraging stage' during the early stages of the project to stimulate innovation. During this stage, a number of factors are identified which influence creation of an organizational environment conducive to innovation, including culture, linking innovation to flexible strategic corporate objectives, leadership built on transparency and trust. Davies et al. (2014) identify four windows of opportunities to intervene and promote innovation at various stages of the

project: bridging, engaging, leveraging and exchanging. Their research is focused on temporary project organization - Crossrail megaproject. Yet, there is a scope to explore innovation opportunities in permanent owner organizations and the role of PMOs in driving innovation throughout the projects they initiate. The 'bridging window' and the 'encouraging window' illustrate the importance of influencing innovation at the front-end of projects through leadership, governance management approach, culture, learning and knowledge diffusion. This is also supported by Herstatt, Verworn, and Nagahira (2004) and Reid and de Brentani (2004) who reinforce that the front-end is critical for building and improving innovative capability. We build upon their work to explore the extent to which innovation is stimulated by the PMO from the front-end to the back-end of project lifecycle.

The project front-end has significant opportunities for influencing key decisions, requirements and increasing the chances of innovation opportunities. We argue that the front-end of a project is where the value lies for innovation which should be stimulated throughout its lifecycle (Collyer & Warren, 2009; Shahu, Pundir, & Ganapathy, 2012). Artto et al. (2011) reinforce that the front-end provides the greatest opportunities for innovative capabilities of owner organizations. The PMO is considered to play a key role in stimulating innovation in projects, especially at the front-end phases. Artto et al. (2011) built upon the theories of organizational design and management control, calling for further research into the roles of PMOs in managing and leading innovation in projects.

The interplay between innovation exploration and exploitation

The problem relating to the interplay between exploration and exploitation can be traced back to the work of Burns and Stalker (1961) who state that it becomes inevitable for individual firms in many industries to provide more support for research and development as a condition of their own survival. There is emerging literature into a balance between exploration and exploitation: organizations capable of exploiting their existing competencies while

simultaneously exploring new opportunities (Andriopoulos & Lewis, 2009; Brady & Davies, 2004). Exploration involves risk taking, innovation, flexibility, and experimentation; whereas exploitation involves refinement, pursuing efficiency, and implementing explored innovations (March, 1991). Striking a balance and a continuum between the two approaches, what is commonly referred to 'ambidexterity', is where the challenge lies and can result in system survival or success (O'Reilly & Tushman, 2008; Turner & Lee-Kelley, 2012). However, this is challenging to achieve due to the different organizational structures and support required for both approaches (Liu et al., 2012). Over emphasizing exploitation can compromise competitiveness in the long term, whereas too much exploration can lead to self-destruction, uncertainty and failure (O'Reilly & Tushman, 2008). Gupta, Smith and Shalley (2006) suggest that both exploitation and exploration can occur simultaneously, however, Andriopoulos and Lewis (2009) argue that exploration and exploitation are cyclical where one succeeds the other. Whereas Liu et al. (2012) state that this can only be achieved by either creating new permanent or temporary separated structures or by promoting an environment empowering employees to seek both.

The ways in which the balanced approach as a duality between innovation exploration and exploitation works in practice remain largely under-explored. There is little in the literature detailing ambidexterity in complex forms of project organizing. Throughout the project lifecycle there are opportunities to explore and exploit innovations (Davies et al., 2014; Loosemore, 2015; Turner et al., 2014). For example, Liu and Leitner (2012) argue that as the project progresses the focus gradually shifts from exploration to exploitation, subsequently reducing uncertainty. Davies and Brady (2016) argue that dynamic project capabilities are used to explore new possibilities and deal with rapidly changing and uncertain conditions, whilst at the same time are used to exploit current routines and perform repetitive processes. They distinguish between routine projects which are focused on exploitation and organized to

achieve predefined goals with a given set of resource constraints; innovative projects which are focused on exploration, organized to deal with highly unforeseeable conditions when the means to achieve the objective is too difficult to define at the outset; and vanguard project which investigate new opportunities, encourage creative problem solving and efforts to establish new routines. We build upon their work in this article and reinforce that owner and operator organizations aim to balance exploratory and exploitative innovation activities in projects over time and become ambidextrous organizations.

Research methodology

Research design

Owner and operator organizations provide an appropriate research context for the very reason that they are recognized as driving innovation in projects which they initiate (Winch, 2014). Transport for London (TfL) is a public transport owner and operator organization with a multi-billion-pound capital investment programme is selected and is an influential stakeholder within the UK infrastructure sector. It sees itself as having a capability to drive and dictate innovation and change. With an expensive and complex capital investment programme and ever tighter squeeze on finances, the risk of uncertainty and the need for greater control of limited resources means the pursuit of innovation is challenging. This challenge is increased when mega-projects are launched and fail. The ‘Sub-Surface Rail – Automated Train Control Programme’ is a prime example which resulted in early contract termination with an £80m termination fee and an estimated £900m loss. This placed TfL’s project delivery capability under greater scrutiny and resulted in numerous recommendations for improving project performance and delivery, including increased internal assurance, access and appointment of specialist skilled roles into management, supplier leadership, organizational and management capability, active risk management and greater scrutiny during the tender process (KPMG, 2014). Critically, the KPMG review did not list ‘innovation’ as a recommendation to improve project delivery

capability. However, the recent successful implementation of early contractor engagement at Bank Station Capacity Upgrade is an example of innovation being created, practiced and championed within the same organization (Sergeeva & Zanello, 2018).

Data collection and analysis

A total of ten semi-structured interviews were conducted in alignment with the research question. Semi-structured interviews were selected to provide a level of flexibility and the ability to extract detailed accounts (Bryman, 2008). Using qualitative semi-structured interviews research method enables to focus on practitioners' perspectives and interpretations on the role of PMO in driving innovation in projects. A purposive sampling approach was selected with a focus on participants' engagement with the PMOs in the organization and experience of the entire project lifecycle. An invitation to participate in the study was sent to all relevant people within the organization. Each interview contained six core questions followed by sub-questions and lasted 45-minutes on average (see Appendix A for details). Initially, participants were asked to provide the definition of innovation. Participants were then asked to identify barriers of innovation within TfL, about the existing processes in relation to PMO and project lifecycle and their connection with an innovation. These sub-questions were either pre-arranged or adapted to the line of questioning. Additionally, documents of the four project assurance reviews were examined to better understand the ways innovation is stimulated in projects at TfL and the role of PMO in this process. Finally, an analysis of the TfL lessons learned portal was undertaken to supplement both interviews and project assurance reviews. The project assurance reviews were selected on the basis of their outcome about the innovation success. Lessons learned portal analysis concentrated on entries focussing on innovation. This allowed to see the bigger picture of the ways innovation is driven by PMOs through different mechanisms and channels in owner and operator organizations. Table 1

presents the details about the organization and participants, their job titles and number of years of experience; reviewed projects and associated participants with these projects.

Organisation	Participants and their job titles	Years of professional experience
Transport for London Project Management Practitioner(s)	Participant 1 – PMO Manager Knowledge Lead Participant 2 – Project Manager Participant 3 – Project Manager Participant 4 – Assistant Project Manager Participant 5 – Construction Manager Participant 6 – Assistant Project Manager Participant 7 – Lead Project Engineer Participant 8 – Systems Engineer Participant 9 – Principal Project Sponsor Participant 10 – PMO Manager	17 3 14 2 22 2 12 6 5 4
Reviewed Projects	Associated Participants	
Project A: Failed innovation but	Participant 6 – Assistant Project Manager	

successfully delivered (£12.5m)	
Project B: Successful innovation and project (£34m)	Participant 5 – Construction Manager
Project C: Failed innovation and failed project (£354m)	Participant 7 – Lead Project Engineer
Project D: Live Mega-Project with active innovation (£1bn)	Participant 9 – Principal Project Sponsor

Table 1: Characteristics of organisations and participants interviewed

All interviews were recorded and fully transcribed by the second author. The analysis was conducted to identify emerging patterns from the semi-structured interviews (Yin, 2009). Codes were generated from the interviews and categorised into themes and sub-themes. Common themes were deduced identifying similarities and differences within the dataset. An NVivo word frequency analysis was conducted across all interviews to identify common themes (see Appendix B for word frequency analysis). The content analysis of the documents of project assurance reviews and lessons learned portal were conducted manually by reading

and making notes of the common themes. In total 2,359 lessons learned were extracted and analysed from the internal TfL Knowledge Portal.

Empirical findings

Providing context for innovation

Participants provided varied definitions of innovation. For example, 70% of participants identified ‘product’ as part of their definition of innovation and the word ‘new’ was used by all participants. The NVivo word frequency analysis demonstrate that words ‘product’, ‘process’, ‘new’ and ‘improvement’ were most frequently used. The lack of a consistent definition on innovation can be attributed to the professional background of the participants and their respective role within the organization. For example, the participants from the PMO provided ‘process’-focussed definition of innovation:

“Innovation is finding new ways of doing things, it is a process led to improving something” (P1)

Whereas, the project management participants focussed on a ‘product’-based view:

“A new way of doing things, having new ideas, improving performance, products and work processes” (P3)

The project management function has a tangible objective focussed on delivery, whereas the PMO function concentrates on organizational processes, governance and best practice. This variation is an example of the influence of context and the ambiguity of defining innovation.

The extracted lessons learned below was from a project adopting the Innovative Contractor Engagement (ICE) procurement route which involved contractors being engaged early to devise innovative solutions:

“Feedback from the bidders showed a lack of shared understanding of what LUL meant by the use of the term ‘innovation’. This caused the bidders to produce varying schemes of differing levels of innovation”

(P1)

This illustrates the practical consequence of an inconsistent definition of innovation with confusion caused to both contractor and project (Baregheh, Rowley, & Sambrook, 2009).

The interview responses suggest that a consistent definition of innovation is absent at TfL, whereas the lessons learned example demonstrates a need for a shared understanding. The project assurance reviews did not identify innovation being formally defined at the start of any project. But all participants are aware of the need to innovate in response to business and project challenges. This need is evident in the response from the Lead Project Engineer from Project C:

“Old railway, old practices, and old materials; we need to be innovative to keep up with regulations, improvements in technology and the demands of London” (P7)

This is further supported by the Assistant Project Manager stating that innovation will only occur when there is a problem or if the project team are being challenged by leadership. Additionally, the Systems Engineer stated:

“I wouldn't pursue innovation if there wasn't a need or a requirement driven by leadership unless I have identified a demonstrable benefit”

(P8)

Practitioners acknowledge the need to innovate due to the challenges or problems they face on projects. This need can be attributed to the reason why a definition of innovation is not present and is evident in the responses from the sponsor of Project D:

“If we want to be world class we need to innovate, we have to develop and try new things to keep up with the increasing customer, financial, political and technical demands” (P9)

The results corroborate the ambiguity found in the literature, Akintoye, Goulding, and Zawdie (2012) recognize the need for a definition based on project and business context. It is clear that a shared understanding on innovation does not exist in practice and there is a need for it to be present, especially in commercial terms; however, the actual practical application of innovation suggests that the absence of an innovation definition does not affect the successful outcome of innovation. The results continue to fuel the ambiguity surrounding the definition of innovation.

Participants were further asked to explain the importance of innovation at TfL and identify innovation barriers. The most common innovation barriers identified were: resources, governance and control systems, organizational factors, external environment and stakeholders. Of these five, company resources, organizational factors and stakeholders were the most commonly identified barriers. Particular focus was placed on the cost of innovation. As expected, the majority of the findings correlated with secondary sources, including costs, culture, leadership and complexity (Bossink, 2004; Ozorhon et al., 2014; Watson, 2011). Participants connected numerous barriers, including culture and resistance to change which were interchanged frequently. Additionally, leadership, stakeholders, political pressure, public scrutiny and trade union overlapped frequently in participants’ responses. Instances of subjective barriers were present, for example, interview responses identified the need to engage and collaborate with the wider supply chain to innovate and improve performance:

“A lot of the challenges we faced was the Tier 1 failing to manage lower Tiers. We now help Tier 1 and build relationships with the lower Tiers directly” (P3)

However, one of the key reasons why the innovative framework contract used on Project A failed was because of this very interaction with the lower Tiers:

“Our sub-contractors simply were not up to scratch when it came to assurance...we struggled to cope with all the extra governance” (P4)

This quotation demonstrates struggle around project assurance and governance that was seen as a barrier to innovation. A further example is in the identification of Trade Unions as a barrier and the presumed conflict between innovation and project management. Union influence and power, in operational and maintenance environments, was identified as a barrier and a factor of influence that is not currently represented in the literature:

“It is very important to get Union buy-in...If the Unions aren't satisfied nothing will be achieved” (P8)

This was shared by the Principle Project Sponsor and Assistant Project Manager, both identifying a similar issue of being forced to curtail innovative solutions due to the risk of Union objections and the project facing additional costs to train all operatives:

“The operational environment is very resistant to change and is highly unionised, their stance is if it doesn't break- don't fix it” (P9)

On the contrary, Project B highlighted the importance of Union influence. The business case for this complex, high risk and expensive project was supported by operational and maintenance representatives that helped gain management buy-in enabling the project to proceed to authority. It was recognized as important to get a support from the Union at the front-end of a project:

“I decided to meet and talk to Union members at the beginning of the project to build some of their issues into scope...As a consequence I had their support throughout the whole project” (P2)

The Unions are recognized to play a significant role at TfL ensuring the operational environment is safe for passengers and employees and have a significant influence when attempting change. The main finding identified is the importance of engaging the Unions in the project front-end to gain buy-in and support throughout the latter stages of the project.

Tensions between innovation and project management

Tensions between innovation and project management were evident in the empirical findings. These tensions were balanced between the front-end, where the focus is to develop the best solution and delivery where the focus was to ensure efficient achievement of project objectives (Freeman & Soete, 1997; Keegan & Turner, 2002; Lenfle & Loch, 2010). All participants highlighted the importance of cost, time and quality for successful delivery and only the engineering participants identified project management as a barrier:

“Innovation can be an iterative process and project managers tend to kick-back on ideas or solutions that may affect programme” (P7)

“I would always seek the best engineering solution and not the solution to please the project manager” (P8)

All participants identified innovation (varying scale) as a critical factor for delivering projects, however, 70% of the participants stated that the iron triangle was critical to delivery and projects need to be protected from scope creep, increases to the programme and budget. Additionally, 8 out of 10 participants failed to identify any specific project control systems, tools or techniques as barriers of innovation (risk management, scheduling, quality assurance etc.). The management of projects at TfL can provide insight into the why this conflict is present:

“Project management at TfL is a process that is repeated; scale of projects may change but the processes are generally the same” (P3)

This response potentially identifies why there is a dual approach to seeking innovation at the front-end whilst also protecting the project through traditional control systems. The results suggest that project management systems are engrained into the normative organizational processes due to the repetitive nature of project processes. A perfect example of this is Project D which adopted an innovative funding model yet maintained existing methods of project management.

There is further evidence of this in the most successful innovative project reviewed – Project B which undertook several virtual and physical trials to test the designed concept in the front-end prior to committing resources to the project:

“We undertook trials and testing to validate solutions prior to full roll-out or project commitment” (P7)

This demarcation between innovating in the front-end and delivering through controlled project systems is evident in Project A; the specific example of it is the innovative framework contract failed to deliver the prescribed benefits because of an attempt to extract efficiencies through Tier-2 sub-contractors once in the delivery stage.

Three active realities to this conflict were discovered: confidence, importance and obligation. Participants identified that they are confident with innovation in the front-end and moderately during the back-end of projects. They acknowledged the importance of innovation for project delivery and expressed their obligation for delivering within the iron triangle. A further explanation to the co-existence of these three realities is the presence of positivist bias within the participants. One of the reasons why project management and other control systems were not fully perceived as barriers is the role of benefits. All participants, project management, engineering, sponsorship and PMO identified the importance of benefits in the face of financial, engineering and project pressures. This was a consistent narrative throughout all of the

interviews with more than one participant citing Benefit-Cost-Ratio for financing innovative projects. This is best summarised in the quote below:

“Scope creep can result in increased costs and difficulty in delivery, but scope creep in the other direction can result in loss of benefit realisation” (P9)

Based on the research collated, it can be suggested that the project community at TfL has a consensual focus on benefits and is open to innovation for realizing project benefits with an expectation of achieving positive outcomes from innovative activity. The findings identified tensions between innovation and project management, however, there is a clear demarcation of these tensions from the front-end to the back-end of projects.

Innovating through the PMO throughout the project lifecycle

To ascertain the suitability of utilizing the PMO to drive innovation throughout project lifecycle, participants were asked to identify at which stage of the project lifecycle they feel most comfortable to innovate. Additionally, the level of interaction, method of communication and frequency of information flow between the PMO and project was investigated. Evidence collated from all three sources highlighted the front-end as the best period to explore different innovative solutions and influence project direction:

“Front-end allows flexibility to explore different options and weigh up costs and the best solution for business” (P4)

The findings concur with literature with participants stating they were open to and actively seeking innovative solutions at the front-end (Artto et al., 2011; Davies et al., 2014; Hamilton, 2010; Loosemore, 2015; Turner et al., 2014). One participant identified the front-end as their preferred stage for innovating and this anomaly can be attributed to the participant’s position within the PMO and not front-line delivery. A ‘second preference’ emerged: innovating outside

the front-end was not desirable but participants considered exploring and adopting innovative solutions based on possible benefits to the project and business:

“It is challenging to deliver new solutions during delivery due to costs and programme impact. Although would consider if new benefits can be extracted” (P6)

This ‘second preference’ was a consistent theme among the participants suggesting they would be willing to innovate during the latter stages of project lifecycle should the benefits exceed costs. This is also evident in Project B which highlighted an acceptable level of failure when attempting new construction processes during delivery. This can be attributed to the high risk and complexity of the specific project, however, there was also evidence of project control mitigating uncertainty in the front-end:

“Development of additional scope requirements at feasibility and concept stage put pressure on workload and re-works close to stage gate reviews” (P3)

This refers back to the dual approach of innovation and project management at TfL. Changes identified during the front-end close to gate reviews were considered challenging, suggesting that the flexibility required for innovation in the front-end was still compounded by project control mechanisms. Whilst the front-end was identified as the stage for exploring different innovative solutions, innovation process shall continue to the back-end of projects if the benefits could be extracted. Furthermore, the influence of project control was still evident in the front-end suggesting that a project control system was still a focus for practitioners, especially at gate reviews. Additionally, innovation-as-usual is an emerging theme, for example, all participants supported innovation in the front-end and acknowledge a willingness to innovate during delivery. Furthermore, all four project assurance reviews demonstrated the

presence of innovation but none actively sought innovative outcomes. The pursuit of benefits and use of innovation to tackle project and business challenges is further evidence of innovation-as-usual. However, harnessing this presumptive state requires an organizational entity to balance innovation, project management and control discontinuity.

Interaction with PMO

The importance of sharing knowledge and extracting lessons learned was a critical aspect for being 'innovative'. As proposed, the PMO as a driver of innovation was dependent on the interaction between project, business and the PMO. The project management literature identified this interaction through the mechanisms of knowledge management, diffusion of learning, project control and assurance (Artto et al., 2011; Aubry et al., 2010; Pemsel & Wiewiora, 2013). The findings demonstrated a consistent information exchange between management, PMO and project management functions throughout the project lifecycle. Three frequent interactions were recognized: stage gates, periodic reporting (progress, finance etc.) and knowledge sharing activities. Participants 2, 3 and 9 highlighted the authority of the PMO in the front-end with the PMO influencing the delivery and procurement methodology and approving projects to proceed through gates. This is also evident in the role of the PMO championing the use of the Innovative Contractor Engagement approach across the business. The findings support the research of Davies et al. (2014) and Loosemore (2015) about the windows of opportunities. This article contributes to the literature by recognizing PMO playing a driving role in the innovation process throughout project lifecycle. A further critical element to bolster this claim is the role of knowledge management and learning for innovation. Findings suggest that a relationship between learning, exploration and management of innovation exists (Gupta et al., 2006; March, 1991; O'Reilly & Tushman, 2008). For example, 7 participants mentioned the importance of using lessons learned from previous projects to explore innovative solutions for future projects:

“We were able to reduce our programme, costs and reduce customer impact, due to the shared knowledge and through the use of innovative techniques and processes gained from other projects” (P3)

Additionally, the PMO takes a proactive approach to managing knowledge on complex projects:

“We actively approach projects that are high risk, high EFC and politically sensitive at all stage gates for lessons learned and knowledge sharing” (P10)

The findings have demonstrated that existing PMO structures and processes penetrate throughout the project lifecycle, PMO has influence at the front-end and the back-end through knowledge management processes and procedures are actively being used by the project community.

Discussion

Our empirical study demonstrates that the PMO has a role in coordinating and stimulating innovation and change through spotting and identifying opportunities for innovation to delivery projects successfully. The PMO enables a communication chain between the actors, projects, programs and portfolios. Our empirical findings support the emergent literature on the PMO as an organizational innovation initiated to assist owner and operator organizations in managing and coordinating portfolio of projects (Aurby et al., 2007; Bredillet et al., 2018), as well as in developing, enhancing maintaining project and innovation management competencies and capabilities (Turner and Lee-Kelley, 2012). We show that PMOs within owner and operator organizations play an important role in stimulating innovation in projects from the strategic front-end to the operational back-end. Our findings are consistent with Artto et al. (2011) who outline the role of PMOs as an integrative arrangement for innovation.

Transport for London, owner and operator organization, can be seen as ambidextrous focusing on a balance and continuum between innovation exploration and exploitation activities. The empirical findings demonstrate the project front-end provides the greatest opportunity for innovation exploration, whereas the project back-end provides the greatest opportunity for innovation exploitation. PMOs play an important role in integrating and balancing innovation exploration and exploitation throughout project lifecycle. This is consistent with Davies and Brady (2016) who acknowledge the challenge of balancing innovation and routine activities in complex projects containing a variety of predictable and highly uncertain conditions. Owner and operator firms aim to simultaneously exploit current routines and explore new opportunities that will define the future.

Innovation is stimulated in an owner and operator organization through the PMO throughout project lifecycles. This is based on the evidence of organizational structures and processes of the PMO being utilized during project lifecycle for innovative project delivery, including knowledge sharing, promotion of innovative project and procurement methods, and influence over project approval. The common narrative is focused on benefits, innovation-as-usual and the professional obligation of participants to respond to the financial, political and technical challenges faced by the business. This is underpinned by the PMO knowledge management mechanisms to influence the selection of the project management systems, procurement strategy and the feasibility of the proposed solution. Assuring the selections will require the PMO to collaborate with the sponsor and union representatives that were identified as key factors of influence. At the front-end of projects, the PMO assists in the development of the project deliverables (feasibility study, concept design etc.) and in the formation of the project system aligned to project objectives irrespective of a focus on innovation (management, procurement and governance strategy). Additionally, the PMO assists in implementing an appropriate knowledge management strategy. During the project delivery, the PMO focuses on

traditional routine assurance of delivery and ensures innovations that occur outside the front-end are supported – subject to justification of benefits. PMO supports the occurrence of innovation during the delivery stage through mechanisms such as change control. Table 2 below summarises the key roles of PMO in stimulating innovation in projects initiated by owner and operator organizations.

Key roles of PMO in stimulating innovation in projects	Detailed explanation
PMO as a stimulator of innovation from strategic front end to the operational back end	<ul style="list-style-type: none"> • PMO assists in spotting and identifying opportunities for innovation to delivery projects successfully • PMO increases interaction with key stakeholders with high influence of key actions to drive innovation in line with business strategy • PMO assists in the formation of innovation strategy • PMO enables communication chain between the actors, projects, programs and portfolios
PMO as a supporter of innovation throughout the project lifecycle	<ul style="list-style-type: none"> • PMO ensures innovation that occurs outside the front-end is supported – subject to justification of benefits • PMO supports the occurrence of innovation during the delivery stage through existing mechanisms such as change control

<p>PMO as a coordinator of innovation throughout the project lifecycle</p>	<ul style="list-style-type: none"> • PMO enables and coordinates a balanced approach to building and enhancing exploration and exploitation innovation capabilities • PMO assists in improving firm's ability to refine the existing knowledge domain and continuously create new knowledge and take opportunities • PMO enables and coordinates building and enhancing knowledge management capabilities
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Table 2: The key roles of PMO in stimulating innovation in projects initiated by owner and operator organizations

The article contributes to the previous studies that outline the role of PMO as an integrative arrangement for innovation (Artto et al., 2011; Aubry et al., 2007, 2008). It clarifies that the project front-end provides greatest opportunities for building innovation and knowledge management capabilities, and back-end continues to provide opportunities for exploiting them further. Yet we reinforce that the interaction between innovation exploration and exploitation is continuous and balanced from the strategic front-end to the operational back-end. The balanced approach is best understood through a duality of control/flexibility, formality/informality, exploration/exploitation (Turner & Lee-Kelley, 2012). This is a fresh perspective on the ways PMOs assist owner and operator organizations in building and enhancing their exploration and exploitation innovation capabilities. It is important to note that leadership and business strategy play important roles in encouraging and supporting innovation (Hobbs et al., 2008).

Managerial implications

This study offers key implications for management in owner and operator organizations. First, owner and operator organizations, and PMO - an internal department there within, play an important role in stimulating innovation in projects. PMOs provide an integrative arrangement for the balanced approach to innovation. Owner and operator organizations can become ambidextrous depending on the extent to which they achieve the balance and continuum between innovation exploration and exploitation. We suggest that the meaning of ambidexterity is best understood as the duality between exploration/exploitation, control/flexibility, formality/informality. PMOs assist owner and operator organizations in improving their ability to refine the existing knowledge domain and continuously create new knowledge and take opportunities. The role of activity and enthusiastic individuals, agents and champions, in owner and operator organizations, play crucial role in leading and promoting innovation.

Limitations of the study and further research

The present study is limited to a single case of owner and operator driving innovation internally through the PMO and is based on limited number of participants. Further research is needed to explore the role of PMOs in owner and operator organizations in stimulating innovation; and more specifically from the strategic front-end to the operational back-end of project lifecycles in encouraging and promoting innovations. Future research may explore ambidexterity in greater detail, as an interplay between innovation exploration and exploitation, and the extent to which the organization maybe seen as ambidextrous. Of further interest is the role of innovation champions and agents in driving innovations in owner and operator organizations in addition to the PMO. The networks of innovations champions and agents in owner and operator organizations is an area that needs further attention.

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Appendix A: Question objectives and sample questions

Question objective 1	Identify definition of innovation
<i>Question(s) 1</i>	<i>What is your understanding of innovation?</i>
Follow up questions	What is your experience of innovation at TfL? How important is innovation to TfL?
Question objective 2	Explore the relevance of innovation to project delivery
<i>Question(s) 2</i>	<i>How important is innovation to delivering projects at TfL?</i>
Follow up questions	At the cost of time, cost and quality?
	Can you identify any examples of innovation? (Product, processes, services)
Question objective 3	Identify barriers to innovation
<i>Question(s) 3</i>	<i>What are your main challenges for managing innovation?</i>
Follow up questions	How have you overcome barriers?
Question objective 4	Identify level of interaction between project/PMO

Question(s) 4	<i>What is your relationship with the project management office at TfL? How often and at what stage do you interact with projects</i>
Follow up questions	Do you consult the PMO with any non-technical issues? Do you agree with the PMO?
Question objective 5	Determine the stage at which innovation is most likely to occur
Question(s) 5	<i>At which stage of the project do you feel the most comfortable with trying new ideas or concepts that have an element of the unknown?</i>
Follow up questions	How often do you interact with the PMO?
Question objective 6	Identify the importance of the iron triangle
Question(s) 6	<i>How important is protecting your scope, budget and programme as a project practitioner?</i>
Follow up questions	What would you prefer? Delivering on time, under budget and to scope or delivering a novel item that could potentially be beneficial for the industry and business at the cost of time, cost and quality?

Appendix B: Word frequency result (NVivo)

Most frequent words	No. of exact and stemmed occurrences in responses to Q1	No. of stemmed occurrences through entire interview – all questions	Average frequency across 6 questions
Product	7	20	3.3
Process	7	36	6
Services	5	16	2.7
Technology	4	24	4
New	11	70	11.7
Improvement	6	18	3