Project capabilities for operational outcomes in inter-organisational settings: The case of London Heathrow Terminal 2

Vedran Zerjav *, Andrew Edkins, Andrew Davies

Bartlett School of Construction and Project Management, University College London, UK

Abstract

Project and strategic management scholarship recognises the importance of project capabilities that allow firms to deliver projects. Although work on project capabilities is a fast-growing line of inquiry, little is still known about how clients assemble project capabilities to achieve operational outcomes in inter-organisational settings. This study seeks to apply theoretical work on project capabilities to the domain of infrastructure project delivery in order to understand how the assembly of project capabilities in temporary inter-organisational settings contributes to the delivery of operational outcomes. The empirical enquiry takes place in the context of the delivery of London Heathrow Terminal 2. Through an inductive theory building approach drawing upon semi-structured interviews with client-side project leadership, internal documents, publicly available data and ongoing engagement with the field, we identified three key capability-enabling mechanisms that help explain the genesis of project capabilities in inter-organisational settings: (*1*) *reconfiguring project capabilities*, (*2*) *adapting project capabilities* and (*3*) *maintaining project capabilities*. We discuss and expand these findings by engaging with theoretical ideas from project studies, and mainstream strategy, organisation, and management research to induce a dynamic model that can be helpful to guide future research, policy and management practices relating to the client side management of project capabilities.

1. Introduction

Project scholarship abounds with empirical evidence suggesting that projects can succeed in meeting their specified deliverables, but then fail to meet the envisioned operational and use benefits (Morris and Hough, 1987; Flyvbjerg, 2009). This should not necessarily come as a surprise, given that operational performance of business systems and benefit realisation are often defined over time-scales of a different order of magnitude from those in project planning, design, and delivery. Surprisingly enough, however, experience in the delivery of major projects is also fraught with examples of projects that failed to fulfil even the basic operational and use expectations immediately post-handover. In its extreme form, a failed delivery can lead to 'a white elephant' - a liability and embarrassment, rather than an asset for the client's business. One example of such a project was the 'Millennium Experience' that was a year-long exhibition located 'Millennium Dome' in London to celebrate the year 2000, but had to be closed after only one year of being open to the public because of the failure to achieve the visitor numbers and income required to sustain the operations (NAO, 2000).

To avoid this type of situation, clients and owners/operators of both corporate and public projects should possess capabilities for transforming tangible project outputs (e.g., software, built assets) into long-term operational and service outcomes (e.

* Corresponding author.
  E-mail address: v.zerjav@ucl.ac.uk (V. Zerjav).

g., increased productivity, better customer experience) (Morgan et al., 2008). The issue of achieving the transformational capability to transition one-off or small batch projects into day-to-day business operations is the main focus of this paper.

Part of the problem is of pragmatic nature, namely projects and operations are traditionally seen as distinct organisational activities (Shenhar and Dvir, 2007). While a project is a one-off structure and activity which dissolves when its goal is accomplished, an operation is an ongoing organisational and productive activity, such as providing consumer with standardised goods and services (Lundin and Söderholm, 1995). Project Management as a set of practices and as a professional discipline has been historically focusing on the delivery of project outputs and much less (if at all) on the broader strategic and operational issues that organisations are facing (Morris et al., 2012; Edkins et al., 2013; Davies, 2017). As a result of this execution-focused mind-set, the smooth project handover and operational delivery is seen as less of a core activity for project teams, who, more often than not, are incentivised to move on to other projects as soon as they have delivered the outputs stipulated in the project brief. In other words, the responsibility of project teams finishes when project outputs are 'pushed over the line' into the domain of the client/owner who then assumes ownership of the asset (and any operational disruption that comes along with it).

Extant theoretical work on project organisations has emphasised the importance of 'project capabilities' (Brady and Davies, 2004; Davies et al., 2006; Nightingale et al., 2011; Davies and Brady, 2016; Winch and Leiringer, 2016), defined as the ability of firms to deliver projects as the core of their business model. Such capabilities have been recognised as key for the management of projects "*through its life from the front-end engagement with clients and sponsors, through tendering and project delivery, to the back-end hand-over to the customer and provision of on-going support*" (Davies and Brady, 2000). Recent project studies acknowledge that project capabilities are either embedded in firms themselves, but can also be accessed through ecosystems of actors participating in the delivery of projects across domains of projects and programmes, project-based firms, and owner-operator organisations (Winch, 2014). Recent work on project capabilities also began taking on board literature on dynamic capabilities to explicate, for instance, how dynamic capabilities are developed to support the strategic management of projects (Davies et al., 2016). Despite the growing body of work making the connections between project and strategic management literature on capabilities (i.e. project vs dynamic capabilities), there is currently no research into how the project capabilities are assembled and enacted to deliver operational services. The aim of this article is therefore to respond to this call by developing a more nuanced understanding of the key mechanisms and practices, within which clients assemble project capabilities within temporary inter-organisational settings.

We therefore posit the research question for this enquiry as: *How do clients assemble and enact project capabilities for delivering operational outcomes in inter-organisational settings?*

To advance the argument about the project capabilities for the delivery of operational outcomes, we note the importance of the back end of projects and the 'transition to operations', which is where the operational outcomes in inter-organisational settings are realised. Nonetheless, while scholars have identified both the importance of transitions between phases within a project (Lundin and Söderholm, 1995) as well as the challenges of project handover and transition into operations (Morgan et al., 2008), empirical studies into project handovers are few and far in between (Whyte et al., 2016; Winch and Leiringer, 2016). Existing work, for instance, elaborates the data handover practices within a limited window of time (Whyte et al., 2016) and the aftermath of a failed handover and operational delivery (Brady and Davies, 2010). These studies are important as they begin to unpack some of the project capabilities that are necessary not only to deliver but transform projects to their long-term operational and use existence. The identified paucity of research into operational drivers and their implications for projects (Davies et al., 2009, 2016; Brady and Davies, 2010; Whyte et al., 2016; Winch and Leiringer, 2016) in the context of the *systems lifecycle* approach, which integrates strategic, delivery, and operational considerations into a multi-domain decision-making continuum (Edkins et al., 2013; Morris, 2013; Artto et al., 2016; Matinheikki et al., 2016), provided this study with the theoretical basis to better understand the capability-driven processes for the delivery and transition of projects in a multi-organisational setting.

Building upon the above body of work and conceptual ideas, we present this study as an inductive enquiry that proceeds as follows. In the following section, we discuss a selected body of relevant scholarly work on capabilities in both project and strategic management literature. We then introduce the setting for the empirical work in this paper: the handover and operational delivery of London Heathrow Terminal 2 – The Queen's Terminal, the overall success of which was heavily dependent on the successful transition of project outputs (building the airport terminal with its accompanying systems) into service outcomes (using the asset to provide seamless air travel operations for passengers and airlines) from day one of operations. We continue by presenting findings of the inductive analysis of interviews with mainly client-side project leadership representatives and other rich data collected in an engaged scholarship effort. Finally, we discuss the implications of understanding the role of project capabilities in balancing stability and change by formulating a dynamic grounded model that can be helpful to guide future research as well as policy and management practices relating to the management of project capabilities for the delivery of operational outcomes in projects.

2. Capabilities and organisational routines in projects

The concept of project capabilities was originally introduced to show that Chandler's (1990) understanding of organisational capabilities needed to be modified to address productive activities undertaken through projects. Chandler identified two levels – strategic and functional organisational capabilities in

the managerial hierarchy of the firm.[1] But Chandler's work neglected to identify the capabilities required to compete and grow successfully in industries that rarely, if ever, move into high-volume production. Davies and Brady (2000) argued that project capabilities are essential for the competitive advantage of capital goods industries such as aerospace, railway infrastructure and large-scale construction that design and produce complex products and systems as one-offs or in small batches for large businesses, government or institutional customers.

The basic building blocks of capabilities – including project capabilities – are *organisational routines*, often understood as their micro-foundational patterns (Zollo and Winter, 2002; Winter, 2013). Strategic management literature, on the other hand, is clear that ad hoc problem solving and improvisation does not constitute an organisational capability (Winter, 2003). Research on project capabilities historically drew upon various theoretical perspectives associated with dynamic capabilities (Teece et al., 1997) including two main streams of research: the resource-based view (RBV) of the firm (Barney, 1991) and evolutionary theory (Nelson and Winter, 1982), with the majority of research being grounded in the RBV perspective. In their foundational paper, Teece et al. (1997) argued that dynamic capabilities enable top management to purposefully adapt, integrate and reconfigure internal and external resources and routines in novel ways to deal with evolving technology, market and regulatory environments (see also Teece, 2007). At the same time, building on Nelson and Winter (1982), evolutionary theory develops a "dual-routines" perspective. Located in the dual-level managerial hierarchy of the firm, dynamic capabilities – similar to strategic capabilities – are located at the strategic level and used by top management to modify, recombine and create operational capabilities and routines in a changing environment. Operational capabilities, in turn, are relied upon to coordinate and perform a firm's day-to-day productive or functional activities (Zollo and Winter, 2002; Helfat and Peteraf, 2003).

More recent research has developed the idea that dynamic capabilities play a balancing role in keeping pace with a range of environmental conditions, both stable and rapidly changing. Firms need to adopt ambidextrous organisational designs, which will allow them to both explore new and exploit existing opportunities (Raisch and Birkinshaw, 2008; Turner et al., 2015). O'Reilly and Tushman (2008) argue that organisational ambidexterity – the ability to simultaneously exploit a firm's

current routines for existing customers and explore new opportunities that will define the future – is a form of dynamic capability. The convergence of the ambidexterity and dynamic capability underpins conversations about business models and business model innovation (Teece, 2010; Baden-Fuller and Haefliger, 2013).

Informed by an evolutionary perspective on dynamic capabilities, Davies and Brady (2016) develop a dual-routines perspective arguing that project capabilities consist of a collection of routines (alongside functional capabilities) that can be conceived as subset of a firm's lower-order operational capabilities. A distinction is made between routine and innovative projects to show how project capabilities connect to work on dynamic capabilities and ambidexterity. Routine projects exploit a firm's existing knowledge, utilise proven technologies and mature products, and address current customer needs and known market conditions. They depend on traditional forms of project management to achieve predefined goals within given resource constraints. Innovative projects, by contrast, explore innovative alternatives, new ideas and approaches, and create novel markets and technologies. Firms rely on dynamic capabilities to allocate resources and manage their project capabilities consisting of a portfolio of routine and innovative projects (Davies and Brady, 2016). Dynamic capabilities are employed by senior managers to know how and when existing project capabilities should be exploited under relatively stable and predictable technology and market conditions. Established project capabilities may, however, have to be radically revised to keep up with changing and unpredictable conditions or when an innovative project is established to create new technologies, products or services. Research has also shown how firms depend on dynamic capabilities to balance and transition from innovative to routine projects (e.g., Brady and Davies, 2004).

This paper responds to the recent call for more research on how project capabilities are deployed to deal with the variety of conditions contained *within* a single large and complex project (Winch, 2014; Davies and Brady, 2016; Davies et al., 2016; Winch and Leiringer, 2016). Prior research has identified the strategic, commercial, and governance capabilities that infrastructure owner/operators require to manage projects (Winch and Leiringer, 2016) and the project capabilities required to support handover digital information along with physical assets to operators and end users (Lobo and Whyte, 2017).

Organisations – clients, owner/operators and delivery partners – depend on dynamic and project capabilities to deal with the variety of conditions, stable and unpredictable, encountered during a project life cycle extending from the front-end planning, through execution to the handover of an operational asset. We selected the handover stage in a large, complex project as the empirical setting for this research, to study how dynamic and project capabilities are deployed to balance the need to perform stable routines, whilst dealing with unforeseeable events. In this way, project handover can be understood as the critical intersection of dynamic and operational capabilities, to enable the transformation of project outputs into use outcomes.

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[1] Strategic capabilities refer to senior management skills and learned routines needed to support strategic planning, diversification decisions and coordination of functional activities. Strategic capabilities are a source of competitive advantage because they are used to respond to moves by competitors, to innovate by moving into new technologies and market positions, and adapt to a changing environment. Functional capabilities refer to the day-to-day operations performed by the firm including production, distribution, purchasing, finance and general management. Firms rely on functional capabilities to grow successfully and obtain economies of scale and scope by moving from low to high-volume production.

3. Research design

In order to learn about the role of project capabilities for the delivery of project outcomes and their transition into long-term business operations, we chose to undertake an inductive, interpretive, qualitative enquiry (Gioia et al., 2013; Eisenhardt et al., 2016) based on a single case (Flyvbjerg, 2006; Eisenhardt and Graebner, 2007; Yin, 2013). The reasoning behind choosing this approach is because we wanted to explore not generally how client organisations enact project capabilities to deliver operationally successful projects, but what can we specifically learn from those owner/operators who excel at it. Our reasoning is underpinned by the acknowledgement that management and organisation studies should focus on outliers rather than averages (McKelvey, 2006) in order to generate useful and insightful research outcomes. We chose to implement a qualitative and inductive research design that would enable revelatory yet rigorous analysis (Gioia et al., 2013; Eisenhardt et al., 2016) of the organisational practices, as they were reported and co-created with project leadership practitioners (Van de Ven, 2007).

The setting for this research is the London Heathrow Airport transformation programme as an epitome of a large organisational undertaking, in which the delivery can be seen as battling through complexity and uncertainty to deliver value to users and infrastructure operators (Lenfle and Loch, 2016). Moreover, problems that occur during the transition to airport operations can rapidly change the public perception of an otherwise successful project. One of the notable examples of such a situation is the hugely disrupted start-up of Heathrow Terminal 5 in 2008 due to the poor coordination between BAA, the airport owner, and British Airways, the eventual occupier of the new building (Brady and Davies, 2010).

The specific case chosen for the empirical enquiry comprises the project handover and operational delivery of London Heathrow Terminal 2 (T2) – also titled as The Queen's Terminal, through which the project organisation moved into the operations phase of the airport system lifecycle. The methodological justification for the selection of the handover of Heathrow T2 as the case to inform this enquiry is the "extreme" or "critical" case argument (Flyvbjerg, 2006; Siggelkow, 2007; Yin, 2013). We argue for at least three points that justify the criticality that warrants a single-case approach.

First, Heathrow Airport Limited (HAL) as the client organisation (formerly known as the British Airports Authority) faced substantial operational disruption upon the opening of its previous flagship infrastructure project Terminal 5 in March 2008. Since the opening of T2 was in the public spotlight and closely scrutinised by the UK government, the owner/operator simply could not afford the project to be seen as anything less than "the best practice" for an airport opening. Second and noting the previous point, the T2 project experienced a major disruption during its early execution, which motivated adaptation in response (this point is elaborated in more detail in the Case Context section). Finally, the project handover involved a major Operational Readiness (OR) dedicated effort to facilitate the successful operational delivery of the project. Whereas each

of these is a feature of significant interest, when combined with the scale (£2.4bn), the nationally critical role of the project, as well as being part of a major international hub airport, it justifies the selection of the case study on the basis of its critical (extreme) features. Moreover, selecting the T2 handover and transition as a case enabled us to study this unique setting in rich depth and uncover key mechanisms that might help researchers expand the understanding of the role that project capabilities play for the delivery and transition of projects as a combination of dynamic and operational capabilities.

In so doing, we adopted a social-constructivist view (Gioia et al., 2013) in an effort to co-produce descriptions of senior project leadership's meanings and definitions of the T2 project handover situation (Gephart, 2004). The case is therefore revelatory (Gioia et al., 2013), enabling the exploration of how project capabilities are assembled in through the rich empirical context of project handover and transition.

3.1. Case context

Heathrow Terminal 2 (T2), at the time of conducting the research, was an ongoing airport reconstruction project worth £2.4 billion (2014 prices). The Terminal began operating on 4 June 2014 and was officially opened as The Queen's Terminal by HM The Queen on 23 June 2014. Passenger experience and environmental sustainability are claimed as some of the key distinguishing features of the new airport terminal. Other distinctive features include the common multi-airline check-in area, self-boarding gates, as well as a variety of innovative solutions in architectural, structural, and process design. When it opened, the terminal hosted 26 airlines, comprising all 23 Star Alliance airlines, plus Air Lingus, Virgin Atlantic Little Red and Germanwings as non-alliance airlines. T2 was designed across a footprint of 40,000 square meters, to accommodate around 22 million passengers annually, or around 43,000 passengers on 324 flights per day. The passengers are served by 28 gates, eight A380 piers, 60 check-in desks and 66 self-service kiosks. In addition, there are 33 shops, 17 restaurants, 634 toilets, 1340 car parking spaces and 7106 seats in the terminal. T2 comprises two major buildings: T2A and T2B. T2A was designed by Luis Vidal and Architects and was built by a joint venture of Ferrovial and Laing O'Rourke. T2B was designed by Grimshaw Architects and constructed by Balfour Beatty. Early design commenced in 2006 with the first on site construction in 2010 having started after the old T2 building was demolished in 2009.

Besides its national and international importance and its sheer scale and complexity, it is important to note that the project was taking place in the midst of the fast-paced aviation industry, in which mergers and acquisitions and frequent changes in airline business models are as common as regulatory changes in immigration and security policies. The delivery phase of T2 was no exception in that regard as it experienced a disruption when the public announcement was made (Financial Times, 2012) that British Midland International (BMI)[2] - the

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[2] Up till 2012, British Midland International (BMI) had its operational base in Heathrow and it flew to various international destinations.

main anticipated airline occupier for the new Terminal 2 at the time of drawing up the contract and until that point - had been acquired by the International Airlines Group[3] (IAG) with the consequence that all BMI operations were to be integrated with British Airways (BA) shortly thereafter. Given that Heathrow Terminal 5 is BA's main hub and base of operations, the main consequence of this merger was that BMI was going to move its operations to a different terminal, leaving T2 without its main occupier. As a consequence of the unexpected acquisition of BMI, HAL developed and then negotiated a solution in which the new T2 was going to accommodate 23 of the Star Alliance (SA) airlines – a first for any major airport hub. To fully occupy the T2 space, three non-Alliance airlines: Air Lingus, Virgin Atlantic Little Red and Germanwings carriers would also be accommodated. Because these SA airlines were previously spread across other terminals of Heathrow, SA effectively became the lead occupier of the T2 building, with the goal of ultimately serving 22 million passengers per year from a single hub terminal. The business value-add for the SA to occupy the terminal was in the operational and commercial benefits of the *hub-and-spoke* model of operations. In other words, members of the alliance would enjoy the benefits of being collocated in a single terminal by improving the quality of service and opportunity for cross-selling of products of the SA member airlines. This situation led to a fundamental review of which airlines would occupy both T2 and the other terminals at Heathrow, the result of which was a substantial reorganisation of the project further described in the Findings section.

By the same token, motivated by its experience of operational deliveries (particularly the disrupted operational handover of T5) the project's leadership from the owner/operator's organisation commissioned an independent review from a leading international consultancy on lessons learned from various airport openings worldwide. The result was that the management team responsible for the transition between the construction project and business-as-usual operations played a major role in the project. This was achieved through a dedicated Operational Readiness (OR) sub-organisation comprising a team that grew to be more than 300 people. The rationale for such a dedicated organisation was that the client (HAL) had previous experience of the sub-optimal opening of T5, which had major issues when it opened and caused significant reputational damage as a result. After considering the lessons learned from T5, for T2 HAL established an operational team in place two years before the opening date with a strategic focus on passenger experience once the terminal went live. A central focus was on the effort of organising a series of staged user trials during the construction of the terminal. As opposed to more simplistic technical testing of devices, the trials involved people and were organised in a succession going from trialling the use of specific physical units to entire putting pretend or proxy passengers and their luggage in large areas in a progressively complex effort. The project involved 192 trials

with a familiarisation program culminating in around 3000 people in the final trials. The pinnacle of the trials was an unannounced live flight arriving just before the official opening on the 4 June 2014. In spite of all the challenges and complexity outlined above, the airport opening was widely perceived as entirely successful, with various public media making references that attribute the successful opening to the "soft launch" strategy that was implemented in the project, as compared to the 'big bang' full opening of T5 (Financial Times, 2014).

3.2. Data collection

Data collection is based upon two key forms of primary data: semi-structured interviews and structured practitioner engagement with senior project leadership members in the client/owner organisation, together with secondary data. This was conducted over a period of six months during 2014 where all three authors engaged with the project leadership practitioners (Van de Ven, 2007). Our goal was to collect rich data as to examine project leadership perceptions of their lived experiences associated with the assembly and enactment of project capabilities for project delivery, handover and transition so as to build novel theoretical and practitioner-oriented insights (Gioia et al., 2013).

We approached a variety of key informants in Heathrow Airport Limited (HAL), the project client organisation, to interview them about key routines around the (successful) operational delivery of the project. Our presumption was that addressing organisational routines as the unit of analysis (Zollo and Winter, 2002; Pentland and Feldman, 2005) would reveal the key features of how the project capabilities were assembled in the temporary inter-organisational setting as the empirical setting of this study. The interactions with representatives of project leadership were in the form of a series of in-depth semi-structured interviews (Spradley, 1979) with selected individual informants. In setting up the research study, we followed guidance on speaking as a mode of practice (Marshall, 2014) and let the informants enact key concepts through speech. The key informants were selected from different levels of client-side project leadership team primarily focusing on (1) management, (2) organisational units, and (3) technical systems teams (e.g., buildings, baggage handling, and information and communication systems). The informants were selected through "snowball sampling" whereby we made the entry into the organisation through the head of the Operational Readiness team and then requested additional key contacts in other teams relevant for studying aspects of the operational delivery of the airport. As a result, the initial list of informants expanded as the interviews were being conducted. With minor discrepancies, each interview was structured similarly and lasted in the range between a minimum of 45 min and a maximum of 2.5 h. All but three interviews were attended by all three authors, who contributed to the interview protocol and took notes independently in order to strengthen the internal validity of data and its interpretation.

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[3] International Airlines Group (AIG) is currently the holding company of Aer Lingus, British Airways, Iberia and Vueling.

After each interview session, we discussed and compared interview notes to try to identify the most prominent emergent categories and themes. This also represented the beginning of the data analysis effort. We continued to conduct subsequent interviews until reaching the point of saturation where we reflected and concluded that significant new features were no longer being reported (O'Reilly and Parker, 2013). All interviews were digitally audio-recorded with informants' consent, which resulted in a total of 17 h and 10 min of audio recorded material that was subsequently transcribed to allow for a rigorous data analysis effort (Corbin and Strauss, 2008). Table 1 gives an overview of the in-depth interview accounts.

Besides semi-structured interviews, we also engaged with the practitioners through a number of structured activities, which contributed to the rich data collection (Van de Ven, 2007). For example, we organised a group feedback workshop to present and discuss preliminary findings with interested members of the owner/operator organisation. The session was held on 19 November 2014 and hosted a total of 13 participants alongside the researchers. The duration of the validation workshop was 1.5 h, which was split into an extensive presentation of the ongoing research followed by a feedback session and an open discussion about pathways to improve the operational delivery of future projects using emerging findings from the ongoing research. We also attended a number of research meetings with senior owner/operator representatives to discuss emergent findings. One of the outcomes of this engagement effort was the launch of a postgraduate module within the authors' institution on the transformation of projects

into operations on the basis of this research. Finally, we attended and contributed to a dedicated event on the delivery on T2 organised by an external professional body. Secondary data that fed into the analysis critically included two externally generated reports on lessons learned in the delivery of the project and relevant project documentation such as schedules and PowerPoint presentations on various aspects of the handover. Such a variety of data sources combined with the deep engagement with the field has been reported to lend itself to an insightful inductive theory building (Gioia et al., 2013).

3.3. Data analysis

Drawing upon interview transcripts, notes, and secondary sources, we analysed the rich data following the relatively well-known "Gioia" method for inductive theory building in organisation research. The coding strategy comprises a two-step analytical routine moving from informant-centric (1st order) to theory-centric (2nd order) constructs with the aim of developing a dynamic grounded theory explaining the phenomenon under observation (Gioia et al., 2013). The first data analysis stage in the protocol is the 1st order coding effort, where we focused on identifying key categories that encapsulated the features that informants attributed to the organisational routines that led to successful operational delivery of the project (and consequently, the enactment of the project capabilities for operational outcomes in an inter-organisational setting). The second stage of the protocol warrants a comprehensive literature overview and 'constant comparison' of the first-

Table 1
Project leadership informants in the semi-structured interviews.

Informant	Role on project	Organisation
Interview session 1: 28 May 2014		
Sally Blackwell	Head of operational readiness	Heathrow Airport Limited (HAL)
Interview session 2: 24 June 2014		
Bally Grewal	IT programme director T2	HAL
Richard Walker	Managed service provider lead T2A	Consultant to HAL
Mark Dunn	Operational readiness manager	HAL
Duncan Pickard	Project director T2A	HAL
Interview session 3: 26 June 2014		
Steve Anderson	Project controls manager	HAL
Ciaran Creamer	Baggage systems delivery project manager	Contractor
Andy Garner	Airline readiness director T2	HAL
Karen Yorath	Delivery manager T2A	HAL
Andy Limb	Information and communication systems delivery lead T2	HAL
Jason Cowell	Delivery lead T2A	HAL
Interview session 4: 1 July 2014		
Tony Court	Construction director T2A	Contractor
Phil Jones	Information and communication systems delivery management	HAL
Interview session 5: 10 July 2014		
Brian Woodhead	Operations director T2	HAL
Graeme Ross	Systems integration & baggage IT manager	HAL
Interview session 6: 4 December 2014		
Steve Anderson	Projects controls manager	HAL
Gavin Payne	Business change manager	HAL

order (theory-free) concepts with theoretical ideas that will drive the analytical process towards the 2nd order theoretical constructs. In this stage, we extensively engaged with the literature on projects, strategic management and organisation studies, to identify concepts that might have relevance in driving forward the research agenda on how project capabilities are assembled for the operational delivery of projects in an inter-organisational setting. This led to the development of the 2nd order themes and - as a further step - overarching theoretical dimensions, as key capability-enabling mechanisms for operational outcomes. It must be mentioned that whenever reached a low level of agreement in understanding of the particular coding, the data was revisited, the different interpretations reconciled so as to arrive to a consensual code label. At the same token, we made sure to validate the link between the 1st order, 2nd order, and aggregate concepts by discussing the practical implications of the theoretical ideas that were emerging so as to maintain the thread of 1st order findings and categories translating into 2nd order themes and – further - overarching theoretical dimensions. Doing this enabled us to achieve a high level of inter-coder alignment and agreement. The final step in the protocol was to translate the above described data structure into a dynamic grounded theory model that explicates how the different analytical categories come together in an organisational setting. We developed such a model drawing upon the 'thick narrative' that the single case context enables. This allowed us to (1) develop what we believe are revelatory findings about the management and governance of project capabilities for operational outcomes in inter-organisational settings, an area clearly identified as sparsely explored and, (2) 'open up' a future research agenda using the project back-end as the empirical setting. This reasoning drove the overall coding and data structure shown in Fig. 1 and Table 2 in Appendix 1. Moreover, because we disclosed the roles of the group of senior informants who contributed to this research, all the quotes are reported in a non-attributable format for confidentiality purposes.

4. Findings

To translate the field notes into 1st order categories and 2nd order themes, we mainly consulted literature in project studies and strategic management, referring to capabilities literature which was relevant to describe the client's perspective we were interested to learn more about. We next discuss these findings along the lines of three overarching theoretical dimensions, which directly translate into key capability-enabling mechanisms: (1) *Reconfiguring project capabilities*, which was about the need for the project to learn from previous decisions made in the given organisational context; (2) *adapting project capabilities*, which is about the need and ability of the project to respond and adapt to the external environmental conditions while still adhering to its original brief; and (3) *maintaining project capabilities*, which we found to be an important mechanism in how project teams and leadership developed new routines that allowed them to improvise while continuing to work in face of uncertainty and change. In presenting the findings, we will focus on a brief outline of each key

mechanism for brevity purposes. This brevity implies that we chose not use informant quotes in presenting the overarching dimensions (key capability-enabling mechanisms), but include them as Appendix 1 (table of dimensions, themes, categories and data).

4.1. Reconfiguring project capabilities

"Nothing new on T2!"

The first capability-enabling mechanism that emerged as an aggregate dimension from the informant accounts was related to the historical and organisational context in which the delivery of the project was taking place. Informants made numerous references to the delivery of the owner/occupier's previous flagship project - T5. Although few of the project leadership representatives interviewed had worked on T5, it was clear that history mattered and in the high importance that was given to successful handover of the project to operations. This also meant that the owner/operator organisation has put so much emphasis on the management of the handover that they gauged the success of the entire project in relation to that. "No news is good news" in terms of journalistic headlines was both the aspiration and hope of project leadership as the opening date approached.

We found that the reconfiguring of project capabilities based on organisational learning was key to this process. Heathrow is an international hub airport that accommodated 75.7 million passengers in 2016. The criticality of the role that this infrastructure asset performs for the UK national economy is difficult to overestimate. At the same time, the delivery of the strategic pipeline of projects for this client has had a track record that sets a high bar in terms of delivery and operational performance. Being the successor of T5 – widely perceived to be a successful project despite the problematic opening – had a particularly powerful effect of framing the expectations in terms of delivery and opening. The unavoidable exposure to public media was significant and the owner/occupier simply could not afford any kind of perceived failure either during the delivery or upon commencement of operations of the project. This had led to a risk-averse strategy in the handover of T2. This meant a careful consideration of the operational factors early in the project and the establishment of the Operational Readiness (OR) organisation six months out from the opening date as an intermediary stage to integrate the project with long-term operations and to cross the critical point on the opening day. Different aspects of the OR organisation will be covered in the subsequent overarching dimensions/capability-enabling mechanisms.

The other important factor to consider is the reputational risk that the owner/occupier would have faced upon an unsuccessful completion and handover of the terminal. For business reasons, it was in the interest of the owner/occupier to deliver the most innovative and cutting edge technological and service solutions alongside this terminal. Solutions such as the hub-and-spoke business model, automated boarding gates, and self-check-in process, were part of this mix. Competing in the cut-throat market of air transportation, it was important for the owner

1st order categories   2nd order themes   Aggregate theoretical dimensions

A. Expectations of big client -
media coverage   1. Legacy
                                        expectations
B. Experience of T5 means   Reconfiguring project
opening must be smooth   capabilities
                                        2. Reputational risk
C. Competition with other hub
airports

D. Responding to change of occup-
pier while project was ongoing   3. Adaptation
                                        strategies
E. Arranging airline moves   Adapting project
                                                                      capabilities
F. Redesigning check-in process
and area   4. Serendipitous
                                        innovation
G. Reconfiguring the ground
handling process

H. Idea of Operational Readiness
as 'the fluffy bit at the end"   5. Rehearsal
                                        mindset
I. Arranging gradually more
complex trials from devices, to
stripes to zones   Maintaining project
                                                                      capabilities
J. Accounting for behavioral
complexity of the terminal -
volunteer trials   6. Building of pro-
                                        gressive confidence
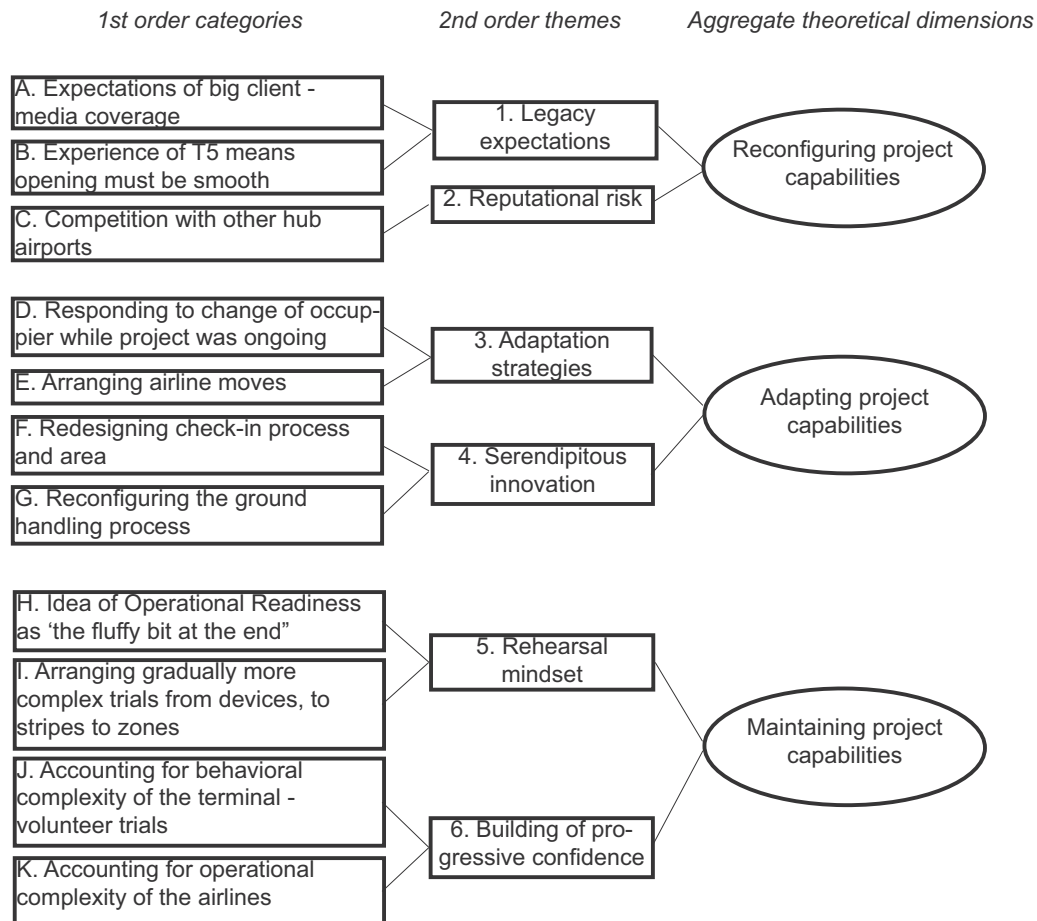K. Accounting for operational
complexity of the airlines

Fig. 1. Data and coding structure.

operator to clearly delineate the value proposition for the project in relation to the comparable airports within the same catchment area. This meant that decisions were not only being framed within the bounds of the organisation itself but how they relate to 'the outside world'.

To summarise the capability-enabling mechanism of reconfiguring project capabilities, we contend that past organisational decisions and experience had an important role in project delivery and transition to operations. The handover of this project had to both deliver against very high expectations in terms of the time-cost-quality outputs, while defeating the expectations of a problematic opening and handover to operations as the main service outcomes. The result, amongst other interventions, was the delivery and transition strategy by establishing OR as a dedicated organisation. We finally argue that the reconfiguring of project capabilities explains the project delivery strategy that in the case project expressly aimed to reduce uncertainty in the handover. This was reportedly embedded into the organisational culture from the onset of the project delivery as can be seen from the table of quotes in Appendix 1.

4.2. Adapting project capabilities

"At that point, it was clear that we could not work as before."

The second capability-enabling mechanism that emerged as an aggregate dimension from the informant accounts related to how the project responded to an unforeseen event - the BMI merger – and the change from having to accommodate the shift from one airline to 26 airline occupiers.

A process had to be created and enacted at short notice to move the various airlines to T2 from other terminals of Heathrow. The new hub-and-spoke model also required redesigning the aircraft ground handling and check-in processes in the terminal building. As a response, informants reported a number of innovative solutions that were implemented in the project in order to accommodate the need for the changes in the project brief. One of such solutions refers to how the project team dealt with the new requirements for the check-in area, originally designed and built to accommodate predominantly one airline, but now having to accommodate 26 different airlines, many of which with very different check-in proce- dures. It became clear that a new solution was needed and it was sought in the form of increasing the efficiency of individual counters. This led to the concept of the common check-in where more airlines would share the same self-check- in kiosks. By designing check-in kiosks capable of dealing with customers from many different airlines, it would be possible to accommodate the significant increase in the number of airlines operating from the terminal. The check-in process was

redesigned and streamlined encouraging solutions such as online check-in, self-tagging, and self-check-in.

At the same time, organising the airline moves in these conditions and against the non-negotiable opening date was a significant challenge for the management of the project. The change in the check-in processes in particular had a significant impact on the airlines as not all of them had the business models, processes and information technology in place to accommodate the new requirement for the common check-in, despite the fact that the airlines were members of the same alliance. This, in turn, meant that HAL needed to work together with the airlines to support them in their moves into the new terminal. The airline moves strategy was arranged in the way that the airlines were encouraged to fulfil both the business- and systems-related requirements first before being granted permission to move into the new terminal. The particular challenge was facilitating the adoption of the common check-in process for the different airlines. The client organisation set up a process whereby the airlines were requested to demonstrate 10 capabilities in a gateway process over a period of 12 months before the particular move was performed. This involved a formal sign-off process by the responsible persons in charge. Finally, the entire airline moves effort was facilitated against a number of dates, some of which were more and some less flexible. The airport opening date of 4th June was the key event, working back from which a number of preceding activities were put in place extending well back into the construction phase of the terminal.

The above vignette articulates the second key mechanism that emerged as an overarching dimension in the coding. The project was exposed to significant pressure through the changing external environment, having a knock-on effect on a variety of domains within the project delivery domain. This has generated a response in the form of various adaptation strategies but at the same time has presented opportunities for innovation. The challenges of having to arrange a number of substantial airline moves and redesign the check-in process and the ground handling contractual arrangement, were all seen as both major unexpected challenges as well as serendipitous opportunities for novel solutions. In fact, many of the key innovative features of the terminal as an operating asset were reported to be a result of 'coping creatively' with the challenges and the need for project reconstitution, adaptation and alignment.

To summarise on adapting project capabilities, we propose that the idea explains the ability of the project in the delivery phase of the lifecycle to address uncertainty while at the same time appreciating that the role of the project was to introduce controlled change into an ongoing stable business, by delivering specific and expected outputs on time and on budget.

4.3. Maintaining project capabilities

"*We know we've been here for our proving trials. We know we've been here on our training. We've done proving trials of volumes. We've done a live flight.*"

The third capability-enabling mechanism that emerged in the qualitative coding related to organising the OR and the processes and routines of its enactment at the back-end of the project. OR was set up to avoid the calamitous openings of many international airports. The operations team made the strategic decision to implement a "soft launch" opening with sufficient buffers in the airport capacity to accommodate any unforeseen events. They wanted to achieve a formal opening that would be a media anti-climax and "non-event" in journalistic headline terms. The period subsequent to the opening was, moreover, planned as a gradual ramp-up period of six months where the airport's operations would be scaled up to smoothly reach its full operating capacity allowing for sufficient time to adapt the processes to the new setting. Based the lessons derived from previous experiences of airport openings, the client management team planned for a specific moment in the project timeline when the organisational and legal ownership of the project would be handed over from the construction and development team to the operations team. This starting point of the transition from the project to operations was referred to by the informants as 'the flip'.

Before the flip, the construction team was in charge of the project and after this symbolic date the operations team assumed responsibility for the project. This was a clear paradigm shift on the project as, in the terms of a construction project, emphasis would have been on the commissioning processes, normally defined in terms of milestones to make sure all the technical systems are in place, *tested and certified*, and the facility is therefore deemed technically ready to be handed over to the operators. However, in operational terms, technical testing is only the starting point for a much more extensive process involving staged *trials* with the purpose of simulating operationally live environments within a functioning airport. Given the time overlap between the completion of all construction activities and the commencement of OR activities, managing this transition was fraught with complexity and unexpected events during the back-end of the project. It was recognised that there would be the need to learn from the feedback gained from the trials which progressed gradually from simple and specific to larger, more frequent, comprehensive and sophisticated activities. The gradual increase of the operational complexity of the trials was meant to address different scales of user and operator interactions in the airport as an operating asset.

The organisations involved in the transition between 'the flip' and the airport opening were dealing with high levels of uncertainty such as the numerous change requests that were generated as the effort went on. The OR was furthermore characterised by a significant overlap between streams of construction and operations work in that operational activities were developed and delivered with a progressively increasing intensity, escalating from the construction phase to full capacity operations. At the same time, project delivery (construction) activities gradually decreased until the point of the operational opening and thereafter until the airport reached its full operational capacity.

Maintaining project capabilities implied a mind-set referred to as "the building of progressive confidence" as the project moved towards full operations. This progressive confidence is characterised by establishing routines, tests and guarantees to ensure a predictable and stable transition process, whilst

providing a space for improvisation and innovation in response to emergent and unexpected events that might hamper a smooth transition. Improvisation was required only when the team encountered challenges and expected changes as the project unfolded.

5. Discussion: a project capability model for the delivery of operational outcomes in inter-organisational settings

This research aimed to understand how clients assemble and enact the project capabilities required to manage the transition from project to operational outcome. Our findings suggest that overarching dimensions of (1) reconfiguring, (2) adapting, and (3) maintaining project capabilities acted as key capability-enabling mechanisms for achieving operational outcomes in the case setting. The most important theoretical implication of the findings is that the dynamic and operational capabilities in projects are much more intertwined than what traditional literature in strategic management acknowledges. This was evident across all three capability-enabling mechanisms, but most obvious in the adaptation domain whereby the client employed dynamic project capabilities to respond to the challenge in the project environment (change of tenant), which at the same time led to new operational-level project capabilities (check-in procedures and baggage handling processes). Maintaining the project capabilities meant that at the interface of delivery and operational domains of the project, new micro-routines had to be assembled, which was facilitated by a mindful process of ad-hoc action and improvising. The second implication is that learning is an underpinning phenomenon that informs the strategic shaping of the project in the front end. It is shaped by history and previous experience that drive the strategic decisions. This was evident in that the key factor for the success of the project was the seamless delivery and operational transition of this project.

We conclude by inducing a dynamic model that integrates the empirical findings from this study with the discussed theoretical ideas from project studies and strategic management. The key point in this capability-driven model for delivery of project-based operational outcomes in temporary inter-organisational settings is to recognise that ownership and allocation of the resources to plan, execute and operate the project is ultimately with firms as legal entities, not the project. The second point is to differentiate between the project and operations as the distinct sides of the systems lifecycle framework. Integrating the two, the research model (Fig. 2) identifies the lifecycle of the system across three main phases of project activity: the (1) front-end planning, (2) project execution and (3) operations and use.

The front-end phase is characterised by planning and strategic decisions amongst a variety of stakeholders. This stage both draws upon and feeds into dynamic project capabilities, helping the client's firm to give birth to the project. Reconfiguring of project capabilities mainly occurs in this stage, which in our case was by shaping the project through organisational experience and learning. What follows is the project execution stage where the delivery teams are working on outputs to fulfil the project brief. The stability of project capabilities is a dominant feature of this phase and their adaptation is required only when conditions change unexpectedly. In the case project this happened through accommodating the project externalities by employing dynamic project capabilities and introducing new (operational) project capabilities. At the same time, delivery stage also incurs most of the (capital) costs that project value will have to be offset against. It is this stage that draws upon and feeds into the core project capabilities, as understood in a traditional sense, which enable the owner/operator to deliver a variety of projects core to its business. The final stage in the systems lifecycle model of project capabilities is operations and use, whereby the constructed asset is deployed, providing long-term services. Maintaining of project capabilities is a key feature of this phase. In the case project this occurred through the process of 'building of progressive confidence', whereby routines were built to support the gradual transition from delivery to operational mode of organising.

Key to this process was the transformation of the management structure, in the case project referred to as 'the flip'. Whereas before the flip, organisation was considered in project terms, after the flip it was considered in terms of operations and use. This gradual transition also represents a critical point where project outputs are gradually starting to be translated into service outcomes. Using a metaphor to illustrate the role of this 'transition to operations' phase, we would like to compare it to the importance of rehearsals in a performance context, whereby success is facilitated with a degree of ad-hoc action while responding to the ongoing situation and interactions.

The dynamic grounded model demonstrates how project capabilities are brought together and enacted to manage the transition from the project to a set of operational outcomes in an inter-organisational setting. This is a result of continuous interplay between client-held dynamic and operational capabilities feeding upon each other and being translated from the project to the firm level and back to the project (Davies and Brady, 2016). Unpacking the project organisation for delivery and transition of the case project, this study revealed three domains of decision-making interventions corresponding to the three key capability-enabling mechanisms: (1) strategic decisions that peak at the beginning of the project and fade away as the project moves into its execution (broadly following the reconfiguration of project capabilities); (2) delivery decisions that by and large encompass the project execution stage with somewhat less relevance for the planning and operations (broadly following the adaptation of project capabilities); and (3) operational decisions that gain prominence towards the back-end of project execution, peak at the beginning of the operations and continue throughout the systems lifecycle through to decommissioning (broadly following the maintenance of project capabilities).

It is however, important to mention that despite the apparent alignment between the capability-enabling mechanisms for operational outcomes and distinct domains of decision-making interventions, we cannot claim that such an alignment exists with distinct phases of the systems lifecycle. This is because it
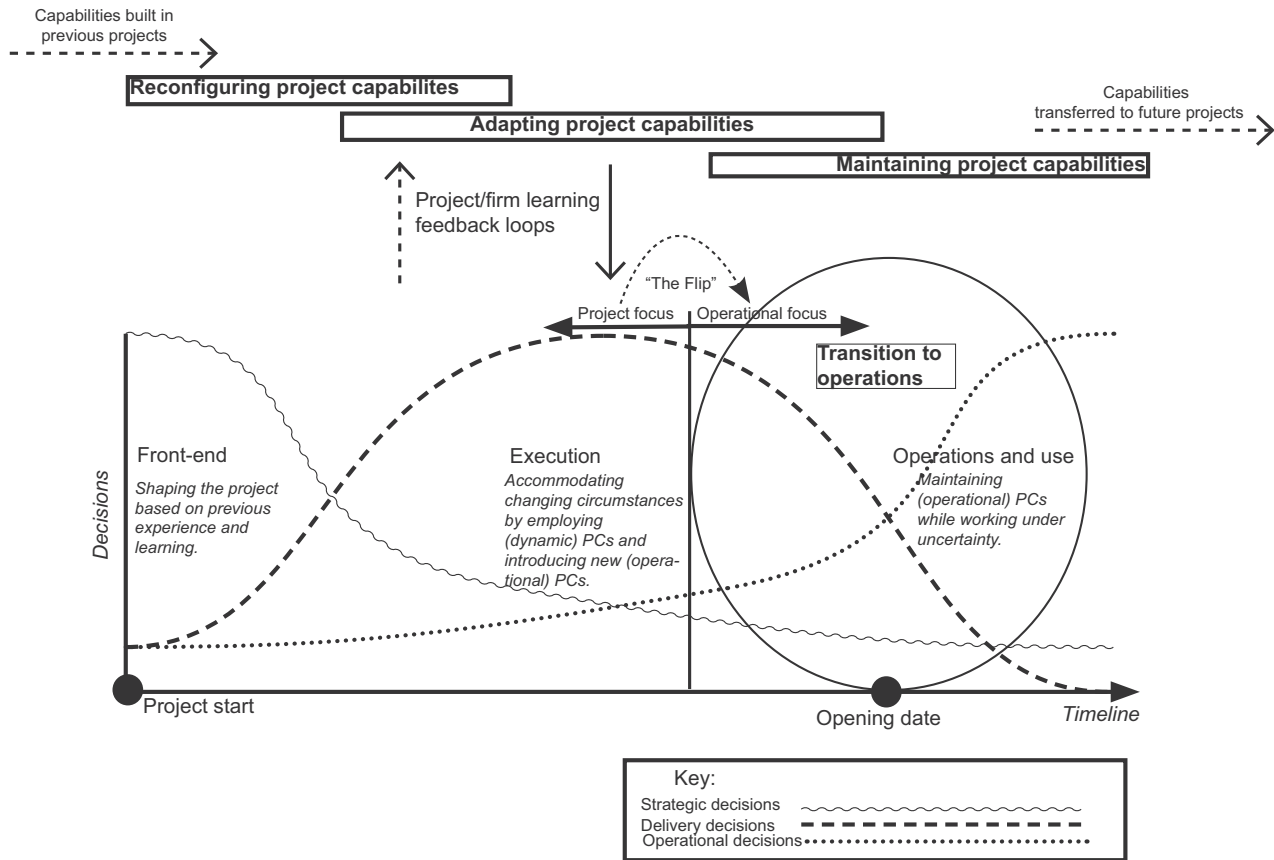
Fig. 2. Project capability model for operational outcomes in inter-organisational settings.

would be inaccurate to claim that strategic decisions exclusively take place at the front-end of the project, delivery decisions exclusively during the execution, and operational decisions exclusively after the project has been delivered. In reality, the three levels of decision-making are intertwined and they occur simultaneously, each extending much beyond its strictly delineated phase within the systems lifecycle. Nonetheless, and as illustrated in Fig. 2, we assumed that the interplay between the different domains of management interventions broadly feeds into the assembly of project capabilities along the front-end planning, execution, and operations stages of the systems lifecycle in the analysed inter-organisational setting. Assuming that the strategic, delivery, and operational decisions achieve most impact in the front-end, execution, and exploitation stages – respectively - we believe that the above model helps to articulate how project capabilities are assembled in the case project, driven by the need to achieve stability in routines with dynamic priorities.

6. Conclusions

The discussion of the findings suggests that clients can enact project capabilities at strategic (reconfiguring project capabilities), delivery (adapting project capabilities), and operational (maintaining project capabilities) levels. The study addresses the acknowledged conceptual tension between stability and change in projects (Davies et al., 2016) as follows. First, the project had

to achieve a balance between conforming to the established path of delivery expectations but at the same time it had to break out of the negative expectations about service outcomes upon handover. Decision-making about this aspect took place in the strategic domain of the owner/operator organisation and the mind-set was one of uncertainty avoidance mind-set ('nothing new on T2 together with a soft 'low key' launch model). Second, the project needed to achieve balance between exploiting the existing opportunities (get the project delivered on time) but embracing opportunities for exploration and serendipity that were the result of the (externally or internally induced) changing requirements. Decision-making about this aspect took place in the (project) delivery domain of the owner/operator organisation and the mind-set was one of uncertainty neutrality (uncertainty is both to be embraced and avoided). Third, the project was enacting a balancing act between stability and improvisation in that while the OR team was working towards the handover, it was clear that reliability could only be achieved by responding to the situation in a 'rehearsal' model. This led to decisions being made at the operational level of considering the asset. Actions taken point to an uncertainty-embracing mind-set (uncertainty was mindfully embraced as a feature of stability).

Although relevant for the entire lifecycle of the infrastructure system, the phenomenon took place at the level of organisational routines (Zollo and Winter, 2002; Bresnen et al., 2005; Helfat and Winter, 2011; Winter, 2013) corroborating

extant project studies that investigated the role of dynamic capabilities to understand project ambidexterity as an act of balancing stability and change in complex projects (Davies et al., 2016). The present study contributes to project studies with an empirical investigation of how dynamic and operational capabilities (driven by routines) interact to shape project capabilities for the delivery operational and use outcomes. This contribution extends recent work on project capabilities (Brady and Davies, 2004; Davies et al., 2006; Nightingale et al., 2011; Davies and Brady, 2016; Winch and Leiringer, 2016) by illustrating the client-led interaction between dynamic and operational project capabilities using the empirical setting of the project back-end in an inter-organisational context. The other important contribution of the study for project scholarship is positioning the mechanisms and processes related to the use of project capabilities into the systems life-cycle context (Edkins et al., 2013; Morris, 2013; Artto et al., 2016).

This work also contributes to theoretical conversations in strategic management literature, which considers routines and capabilities being clearly different from ad-hoc problem solving (Winter, 2003; Teece, 2012). Our work (quite intriguingly) suggests that, although we are focusing on project capabilities, the mutual exclusivity between routine-based capabilities and improvisation cannot account for the practices we observed in our case study. In our findings, the stability and predictability provided by project capabilities provided a space for improvisation and innovation when conditions changed. This supports recent theoretical work calling for research on the mutually constitutive and complementary relationship between stability and change in organisational settings (Eisenhardt et al., 2010; Farjoun, 2010). The maintaining project capabilities mechanism from our findings best illustrates how both stable routines and ad-hoc action were at play in the case context. Albeit at a different analytical level, this phenomenon is also corroborated by studies arguing for organisational improvisation and its benefits for innovation (Eisenhardt, 1997; Diasio, 2016).

As any research, this work has several limitations, which we recognise. First, a single case has limited generalisability. Although we appreciate the limitations of qualitative theorising using single cases, we wanted to achieve an explanatory contribution for the domain of project studies, shedding light upon the subject of project capabilities for achieving operational outcomes in an inter-organisational context, identified as important, but without a structured empirical follow-up. Focusing on such a case allowed us to achieve the analytical depth necessary to reveal the basic features of the phenomenon that future studies should expand on. More specifically, the empirical basis can be expanded by looking into multiple cases

and possibly distinguish between not only individual cases but also classes of project capabilities - according to different sectors, types and scales of projects, to name a few. Future research might also examine project capabilities for the delivery of operational outcomes as a phenomenon that alters during the different phases of the system lifecycle. While this study focused on the project back-end as the intersection between the operational and dynamic capabilities and routines, future work can investigate whether project capabilities acquire a different shape in other stages of the systems lifecycle.

Finally, future research could adopt different epistemological and theoretical angles to understand the phenomenon of project capabilities. One example of such potentially fruitful avenue for future research would be to investigate the unforeseen adaptation, coordination, and alignment challenges that emerge around project handover as a fixed organisational boundary (Zerjav, 2015) while a complex project unfolds as a non-decomposable problem-solving system. Epistemologically, this avenue of future research could adopt the perspective of, for example, organisational design (Simon, 1969/1996; Gil and Baldwin, 2014) or practices (Jarzabkowski and Spee, 2009; Nicolini, 2012; Marshall, 2014). It is though important to note that by identifying some (in our opinion) relevant avenues to drive the future research agenda on project capabilities in inter-organisational settings, we are not excluding other (equally if not more so) insightful or applicable theoretical conversations in project studies, as well as theorising in mainstream strategy, organisation and management studies. Concluding, we argue that future studies could leverage the explanatory power of project capabilities to further explore how exploration and exploitation practices in projects can translate into value accrued after the delivery of projects to users and operators.

Acknowledgments

Appendix 1 Dimensions, themes, categories and data

Table 2

Second-order themes and first-order categories	Representative data
Key: overarching theoretical dimension/capability-enabling mechanism	
N. 2nd order theme	
X. 1st order category	

Table 2 (*continued*)

Second-order themes and first-order categories	Representative data
Reconfiguring project capabilities	
1. Legacy expectations	
A. Expectations of big client – media coverage	A1. "I met the Queen on Monday and she asked me, "Is the baggage system working?" that was her first question. It's just in people's psyche that there was actually a baggage system problem. The reality is it was much bigger than that and..."
	A2. "With regards to commissioning we learnt from, again from T5 there is a real necessity to basically flip from a construction led project to a commissioning led project and then to an OR led project."
	A3. "But what you do find is doing it this way, the media move on very quickly. They're interested in the opening, they're interested in the celebration event and then."
	A4. "Typically what happens in an opening is the excitement is here 'cause you're usually failing, unfortunately, yeah?"
	A5. "One of the key drivers for T2 was, from a build perspective, was to do it the best we've ever done it, to be the safest project, to open it efficiently and effectively, obviously to put the ghosts of T5 to bed, but also conscious that all these other airports haven't been successful."
	A6. "On T5 we did familiarisation, induction and training as one offer, and we said, hang on a second, so let's get this right, on reflection. We're changing the environment within which you work – one big change, and we're teaching you about how to do your job – two big changes."
B. Experience of T5 means opening must be smooth	B1. "From the very beginning we had a slogan on this project: Nothing new on T2"
	B2. "I think T5 could have been done in a softer way as well, perhaps moving T1 first, and then T3 second, or T4 or whatever. So I think T5 could have been done more progressively, it was very ambitious to move it all in one hit."
	B3. "So I came out with - and I'm very happy to share these with you, but I haven't got them to hand – what I call there's almost 10 golden rules that I learnt from T5. These are things like...the very central piece is we opened T5 with 400 flights on the first day. We opened here with 36 flights on the first day. I'm absolutely certain had we opened T5 with 36 flights, it would have been good enough. It would have been good enough."
	B4. "This approach was definitely a result of what we had learned from the opening of T5 – we called it a 'small and often' strategy rather than a 'big bang' strategy."
2. Reputational risk	
C. Competition with other hub airports	C1. "Massively valuable solution that we can apply for Star – they'll go to Paris, they'll go, you know. And they've declared cost savings through what they're doing here, along with a model that customers want to use."
	C2. "They're all either not good or a disaster, you know. Berlin, disaster, Doha, is it open yet..."
	C3. "We actively participate and lead in that arena, and we want worldwide for Heathrow to be seen as being at the leading edge of driving this stuff. But it's quite difficult for others to quickly adopt it. So [a competitor airport], for example, could they adopt it? They haven't got Star down there really in this sort of critical mass."
Overarching dimension: adapting project capabilities	
3. Adaptation strategies	
D. Responding to change of occupier while project was ongoing	D1. "Halfway through, BMI went bust. We again had to rewrite processes, the client changed. The idea was to go to Star Alliance and put them all under one roof."
	D2. "At that point, it was clear that we could not work as before. The traditional check-in would require us to have more check-in desks in this terminal then there was space for."
	D3. "Effectively the building originally was designed and tailored to what BMI and the other airlines wanted, based on their client needs if you like. Us, if you like, being the master client but them being our customers and what do you want within the building."
	D4. "I think it's important to be able to react. That's not relying on a reactive methodology, but you are, you end up having to be reactive, but it's from a position of: we had the capability and we knew that, if you are going to be reactive, this is how we do it. This is the governance, these are the people that you need to involve."
E. Arranging airline moves	E1. "In 18 months 26 airlines had to agree that they will have common IT, [processes, check-in agent, etc.]"
	E2. "So the whole airline moves process that was a big risk, I mean a huge risk of success or failure. People like [airline] didn't want to move into Terminal 2 because they were entrenched probably in their original space. They didn't want to move because it probably frightened them."
	E3. "So what we wanted to do is have all of the airlines certified by us through that model terminal by the end of October last year. The plan never turns out as you expect it, so to be fair three quarters of them got to that point and then we were managing the tail thereafter."
4. Serendipitous innovation	
F. Redesigning check-in process and area	F1. "The biggest innovation on T2 is the common check-in. You can check in for any flight at any desk, allows for best utilisation of the check in desks."
	F2. "But what they said was, in simple terms, by being able to let anybody check-in to any kiosk or any bag drop, we believe we can drive enough efficiency out to actually reduce that. Which then increases

Table 2 (*continued*)

Second-order themes and first-order categories		Representative data
		efficiency, reduces lower costs, or what it is doing is bringing something new in to here that then we've got the challenge of delivering within here."
	F3.	"Clearly, for us, having [airline name removed] as the lead airline was important. They were moving through to time and plan, and the ones that were soon thereafter – [airline name removed], for example, didn't want to do it. They just didn't believe that bag tags at kiosks was the right thing, so they just said flat "we're not going to do it. Our customers don't want to do it". I spent lot of my time on [airline name removed], and Star were very good holding the line that says "well, if the agreement is there, if you don't do it, you don't come"."
G. Reconfiguring the ground handling process	G1.	"People like [airline name removed] had been doing their own ground handling in Terminal 3 for 30 years, or whatever, outsourced their ground handling to [ground handler company name removed], so I think there was, on a single day in early May, [ground handling company name removed] picked up seven contracts, so seven airlines changed their ground handling overnight, and you didn't hear anything about that."
	G2.	"BMI had accommodation requirements for their handling agents. So a lot of the facilities are sized around that, and designed around that. When you look at their flight operations, then that has a big impact."

Overarching dimension: maintaining project capabilities
  5. Rehearsal mind-set

H. Idea of operational readiness (or) as "the fluffy bit at the end".	H1.	"OR is generally seen as "the fluffy bit at the end" and benefits are not too clear to the exec people."
	H2.	"In their heads again it's the fluffy bit at the end that can just wait and they'll get it. The more that you do it, and the more that you show them what you're doing, the more that they understand that actually, "I can see why you're doing that now.""
	H3.	"We know we've been here for our proving trials. We know we've been here on our training. We've done proving trials of volumes. We've done a live flight."
I. Arranging gradually more complex trials from devices, to stripes to zones	I1.	"So we had stripes through the building, was another philosophy that we talked about, was establishing, you know, routes for staff, routes for passengers, and getting those trials done early. And you can do that, you know, you don't need a fully polished building in order to be able to trial, does this work, does our way finding work, do the security systems work, and such like."
	I2.	"So each one of these trials requires some of this to work and some of that. And so the baton almost moves, so the baton continues to move from discipline to discipline. Because at the end of the day these are the guys who get it over the line, so these are the people who finish it off. And they determine how it all works."
	I3.	"And what this also does is this proves that that actually works. So it proves how passengers move, it proves that the check-in process works, you don't get queues. It proves that people can follow the signs. So what this does is this unfortunately introduces change into the box. And it can be minor bits of signage to you know major elements where you haven't got enough lifts"

  6. Building of progressive confidence

J. Accounting for behavioural complexity of the terminal - volunteer trials	J1.	"So the build sequence needs to reflect the Operational Readiness trials and what does that mean you know in terms of facility? How much of the facility needs to be finished to enable the trial to be done?"
	J2.	"I think one of the best learners or one of the best things that happened on T28 which I don't necessarily think happened previously, and I'm sure it didn't because I was back at T5C, was that we had live participants in OR trials and that made the difference. For me, you got the general public view and these guys were playing the part, I mean they were volunteers but they played the part of passengers and they were as vociferous and they were as loud as they needed to be."
	J3.	"Oh they got into the role and to be honest with you, I think the smallest trial we started with was about 100 people and we went through a progressive stage up to 3000 people and that was the 18th or 19th of May, that was just two weeks before the terminal was due to open we did a Saturday trial and there was 3000 people."
	J4.	"There was the, 'Show me you know,' principle, which was done, again out of T5, people went on the training, but there was never any checking that they took anything in. Sounds obvious but more often than not when you're training 25,000 people, familiarising 25,000 people, you just churn, churn, churn! And that's really important, to make sure people feel comfortable to, one, ask questions, but, two, be able to know their routes etc."
	J5.	"[W]hen you think about the operational readiness piece, and what our approach was, and how we turned, going from a compliant building to compliant operations, that operational flow, it was all about building progressive confidence, or capability – confidence through capability, so you could do it. So at the end of it, everyone was not questioning, well, can this work? It was like, no, this can work – we've done it before. We've been here before."
	J6.	"[W]hat we'll do through operational readiness was prove it, test it, train people, so they became familiar with that. We build confidence, one feels."
K. Accounting for operational complexity of the airlines	K1.	"If you are building a building over a number of years, there is a point where the building is so inhabited and being used, and because there's so many trials going, it's basically an operational building, but contractually it's not been handed over…. We had guys commissioning stuff, turning things on, turning things off, yet you had airlines and handlers."

Table 2 (*continued*)

Second-order themes and first-order categories	Representative data
	K2. "One of the recommendations came out saying, "It would be great if you guys executed a live flight before 4th June...."""
	K3. "But, more importantly, and I say more importantly because this is going to happen for the next 30 or 40 years, was to create a step change in our operational performance. We wanted operational staff to take on the safety mantel and carry that through to operations. So there was a lot of great aspiration, to take the level of performance of making every journey better, not just in terms of facility but in terms of people, to another level."
	K4. "Because the challenge here is the facility looks fantastic, but it's not about the facility.... [part omitted for brevity purposes]... [If] it's a tick box exercise, it doesn't prove the capability and it doesn't reduce the residual risk that you're looking to mitigate."
	K5. "[Y]ou improvise as you go along, because the bottom line is, [e.g.] we need the security doors locked. If we don't have a camera, what does that mean? It needs two people. Oh shucks, the guy's sick, the door's unlocked. Right, well who's [going to cover this], we've got a list of back-up people, trained and all that. They can then go and stand in. So if you're improvising, but you're improvising against a well thought out strategy …"

References

Artto, K., Ahola, T., Vartiainen, V., 2016. From the front end of projects to the back end of operations: managing projects for value creation throughout the system lifecycle. Int. J. Proj. Manag. 34 (2), 258–270.

Baden-Fuller, C., Haefliger, S., 2013. Business models and technological innovation. Long Range Plan. 46 (6), 419–426.

Barney, J., 1991. Firm resources and sustained competitive advantage. J. Manag. 17 (1), 99–120.

Brady, T., Davies, A., 2004. Building project capabilities: from exploratory to exploitative learning. Organ. Stud. 25 (9), 1601–1621.

Brady, T., Davies, A., 2010. From hero to hubris–reconsidering the project management of Heathrow's terminal 5. Int. J. Proj. Manag. 28 (2), 151–157.

Bresnen, M., Goussevskaia, A., Swan, J., 2005. Organizational routines, situated learning and processes of change in project-based organizations. Proj. Manag. J. 36 (3), 27.

Chandler, A.D., 1990. Strategy and Structure: Chapters in the History of the Industrial Enterprise. vol. 120. MIT Press.

Corbin, J., Strauss, A., 2008. Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Sage.

Davies, A., 2017. Projects: A Very Short Introduction. Oxford University Press.

Davies, A., Brady, T., 2000. Organisational capabilities and learning in complex product systems: towards repeatable solutions. Res. Policy 29 (7), 931–953.

Davies, A., Brady, T., 2016. Explicating the dynamics of project capabilities. Int. J. Proj. Manag. 34 (2), 314–327.

Davies, A., Brady, T., Hobday, M., 2006. Charting a path toward integrated solutions. MIT Sloan Manag. Rev. 47 (3), 39–48.

Davies, A., Gann, D., Douglas, T., 2009. Innovation in megaprojects: systems integration at London Heathrow Terminal 5. Calif. Manag. Rev. 51 (2), 101–125.

Davies, A., Dodgson, M., Gann, D., 2016. Dynamic capabilities in complex projects: the case of London Heathrow Terminal 5. Proj. Manag. J. 47 (2), 26–46.

Diasio, S., 2016. Not all that jazz! Jamband as a metaphor for organizing new models of innovation. Eur. Manag. J. 34 (2), 125–134.

Edkins, A., Geraldi, J., Morris, P., Smith, A., 2013. Exploring the front-end of project management. Eng. Proj. Organ. J. 3 (2), 71–85.

Eisenhardt, K.M., 1997. Strategic decisions and all that jazz. Bus. Strateg. Rev. 8 (3), 1–3.

Eisenhardt, K.M., Graebner, M.E., 2007. Theory building from cases: opportunities and challenges. Acad. Manag. J. 50 (1), 25–32.

Eisenhardt, K.M., Furr, N.R., Bingham, C.B., 2010. Crossroads—microfoundations of performance: balancing efficiency and flexibility in dynamic environments. Organ. Sci. 21 (6), 1263–1273.

Eisenhardt, K.M., Graebner, M.E., Sonenshein, S., 2016. Grand challenges and inductive methods: rigor without rigor mortis. Acad. Manag. J. 59 (4), 1113–1123.

Farjoun, M., 2010. Beyond dualism: stability and change as a duality. Acad. Manag. Rev. 35 (2), 202–225.

Financial Times, 2012. Iag Secures Discount to Complete Bmi Deal. Financial Times, 20 April 2012. (at). https://www.ft.com/content/c1dd028c-8ac8-11e1-b855-00144feab49a, Accessed date: 27 August 2017.

Financial Times, 2014. Heathrow's Terminal 2 Avoids Repeat of T5 Launch Chaos. Financial Times, 4 June 2014. (at). https://www.ft.com/content/806a4d1e-ebd3-11e3-ab1b-00144feabdc0, Accessed date: 26 August 2017.

Flyvbjerg, B., 2006. Five misunderstandings about case-study research. Qual. Inq. 12 (2), 219–245.

Flyvbjerg, B., 2009. Survival of the Unfittest: why the worst infrastructure gets built—and what we can do about it. Oxf. Rev. Econ. Policy 25 (3), 344–367.

Gephart, R.P., 2004. Qualitative research and the academy of management journal. Acad. Manag. J. 47 (4), 454–462.

Gil, N., Baldwin, C.Y., 2014. Sharing design rights: a commons approach for developing infrastructure. Harvard Business School Working Paper No. 14-025, September 2013 (revised January 2014).

Gioia, D.A., Corley, K.G., Hamilton, A.L., 2013. Seeking qualitative rigor in inductive research notes on the Gioia methodology. Organ. Res. Methods 16 (1), 15–31.

Helfat, C.E., Peteraf, M.A., 2003. The dynamic resource-based view: capability lifecycles. Strateg. Manag. J. 24 (10), 997–1010.

Helfat, C.E., Winter, S.G., 2011. Untangling dynamic and operational capabilities: strategy for the (N) ever-changing world. Strateg. Manag. J. 32 (11), 1243–1250.

Jarzabkowski, P., Spee, A.P., 2009. Strategy-as-practice: a review and future directions for the field. Int. J. Manag. Rev. 11 (1), 69–95.

Lenfle, S., Loch, C., 2016. Has megaproject management lost its way? The Oxford Handbook of Megaproject Management, p. 21

Lobo, S., Whyte, J., 2017. Aligning and reconciling: building project capabilities for digital delivery. Res. Policy 46 (1), 93–107.

Lundin, R.A., Söderholm, A., 1995. A theory of the temporary organization. Scand. J. Manag. 11 (4), 437–455.

Marshall, N., 2014. Thinking, saying and doing in collaborative projects: what can we learn from theories of practice? Eng. Proj. Organ. J. 4 (2–3), 107–122.

Matinheikki, J., Artto, K., Peltokorpi, A., Rajala, R., 2016. Managing inter-organizational networks for value creation in the front-end of projects. Int. J. Proj. Manag. 34 (7), 1226–1241.

McKelvey, B., 2006. Van De Ven and Johnson's "engaged scholarship": nice try, but.... Acad. Manag. Rev. 31 (4), 822–829.

Morgan, M., Levitt, R.E., Malek, W.A., 2008. Executing Your Strategy. Harvard Business School Press.

Morris, P.W.G., 2013. Reconstructing Project Management. Wiley-Blackwell, Chichester.

Morris, P.W.G., Hough, G.H., 1987. The Anatomy of Major Projects: A Study of the Reality of Project Management. John Wiley and Sons, Chichester.

Morris, P.W., Pinto, J.K., Söderlund, J., 2012. The Oxford Handbook of Project Management. OUP, Oxford.

NAO, 2000. The Millennium Dome, Report by the Controller and Auditor General, Hc 936 Session 1999–2000: 9 November 2000. National Audit Office, London.

Nelson, R.R., Winter, S.G., 1982. An Evolutionary Theory of Economic Change. Harvard Business School Press, Cambridge.

Nicolini, D., 2012. Practice Theory, Work, and Organization: An Introduction. Oxford university press.

Nightingale, P., Baden-Fuller, C., Hopkins, M.M., 2011. Projects, project capabilities and project organizations. Project-based Organizing and Strategic Management. Emerald Group Publishing Limited, pp. 215–234.

O'Reilly, M., Parker, N., 2013. 'Unsatisfactory saturation': a critical exploration of the notion of saturated sample sizes in qualitative research. Qual. Res. 13 (2), 190–197.

O'Reilly, C.A., Tushman, M.L., 2008. Ambidexterity as a dynamic capability: resolving the innovator's dilemma. Res. Organ. Behav. 28, 185–206.

Pentland, B.T., Feldman, M.S., 2005. Organizational routines as a unit of analysis. Ind. Corp. Chang. 14 (5), 793–815.

Raisch, S., Birkinshaw, J., 2008. Organizational ambidexterity: antecedents, outcomes, and moderators. J. Manag. 34 (3), 375–409.

Shenhar, A.J., Dvir, D., 2007. Reinventing Project Management: The Diamond Approach to Successful Growth and Innovation. Harvard Business Review Press.

Siggelkow, N., 2007. Persuasion with case studies. Acad. Manag. J. 50 (1), 20–24.

Simon, H.A., 1969/1996. The Sciences of the Artificial. MIT Press.

Spradley, J.P., 1979. The Ethnographic Interview. Holt, Rinehart and Winston New York.

Teece, D.J., 2007. Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. Strateg. Manag. J. 28 (13), 1319–1350.

Teece, D.J., 2010. Business models, business strategy and innovation. Long Range Plan. 43 (2), 172–194.

Teece, D.J., 2012. Dynamic capabilities: routines versus entrepreneurial action. J. Manag. Stud. 49 (8), 1395–1401.

Teece, D.J., Pisano, G., Shuen, A., 1997. Dynamic capabilities and strategic management. Strateg. Manag. J. 509–533.

Turner, N., Maylor, H., Swart, J., 2015. Ambidexterity in projects: an intellectual capital perspective. Int. J. Proj. Manag. 33 (1), 177–188.

Van de Ven, A.H., 2007. Engaged Scholarship: A Guide for Organizational and Social Research: A Guide for Organizational and Social Research. Oxford University Press.

Whyte, J., Lindkvist, C., Jaradat, S., 2016. Passing the baton? Handing over digital data from the project to operations. Eng. Proj. Organ. J. 1–14.

Winch, G.M., 2014. Three domains of project organising. Int. J. Proj. Manag. 32 (5), 721–731.

Winch, G., Leiringer, R., 2016. Owner project capabilities for infrastructure development: a review and development of the "strong owner" concept. Int. J. Proj. Manag. 34 (2), 271–281.

Winter, S.G., 2003. Understanding dynamic capabilities. Strateg. Manag. J. 24 (10), 991–995.

Winter, S.G., 2013. Habit, deliberation, and action: strengthening the microfoundations of routines and capabilities. Acad. Manag. Perspect. 27 (2), 120–137.

Yin, R.K., 2013. Case Study Research: Design and Methods. Sage Publications.

Zerjav, V., 2015. Design boundary dynamics in infrastructure projects: issues of resource allocation, path dependency and problem-solving. Int. J. Proj. Manag. 33 (8), 1768–1779.

Zollo, M., Winter, S.G., 2002. Deliberate learning and the evolution of dynamic capabilities. Organ. Sci. 13 (3), 339–351.