

A Dynamic Capabilities Perspective of IS Project Portfolio Management

Abstract

Organizations use information systems project portfolio management (IS PPM) to reconfigure their IS resources and capabilities to match changing market and economic conditions. IS PPM can therefore be characterised as a dynamic capability. We investigate how firms developed and adapted IS PPM to match the turbulent recessionary conditions witnessed after 2008–09. This study contributes to an understanding of IS PPM by identifying the constituent dynamic capabilities and providing empirical examples of adaptation. To our knowledge, the study is the first to apply the notion of second order dynamic capabilities to the IS domain and also makes an important contribution to the more general concept of dynamic capabilities by providing empirical evidence and theoretical justification of the increased detailed, centrally controlled and analytical nature of IS PPM dynamic capabilities in recessionary conditions.

Keywords: project portfolio management, dynamic capabilities, second order dynamic capabilities, recession, recessionary conditions

1. Introduction

Strategic information systems (IS) literature stresses how increased dynamism in the environment necessitates that firms are agile and can reconfigure their capabilities and resources rapidly (Merali et al., 2012, Tanriverdi et al., 2010). Projects are often the main vehicle for delivering new IS-based business capabilities and for achieving resource reconfiguration in firms. Thus, the reconfiguration required to match and even create market and environmental change relies on identifying, prioritizing and executing appropriate projects (Jeffery and Leliveld, 2004; Ward and Peppard, 2002). This selection, evaluation and implementation of information systems projects is called 'IS project portfolio management' (IS PPM) and is considered a key component of IS strategies in dynamic environments (Earl, 1993; McFarlan, 1981; McFarlan et al., 1983).

We adopt a socio-technical view of IS PPM, where the human aspects are both as important as, and entangled with, technical aspects (Orlikowski and Scott, 2008). IS PPM may include only projects that are considered as primarily IS projects by the organization, or they may also include other projects that have a significant IS component (e.g. change projects, new product or service projects). As we discuss in the Research Methods section of this paper the firms studied demonstrated both approaches to IS PPM. Whilst some IS researchers and practitioners may wish to focus only the management of IS projects, this does not reflect the reality of IS PPM in many organizations and also impoverishes the role and contribution of IS professionals to wider activities within their organizations.

The concept of dynamic capabilities provides a means of understanding how firms change their underlying resources and capabilities (Eisenhardt and Martin, 2000; Helfat and Peteraf, 2009; Teece et al., 1997). Since IS PPM is directed at achieving changes to resources and capabilities, we suggest dynamic capabilities offer an appropriate lens through which to explore IS PPM. Other scholars have characterised PPM¹ in the new product development domain as a dynamic capability (Killen, 2008; Killen and Hunt, 2010). However, their characterisation of PPM as a single, monolithic dynamic capability provides limited insight and understanding. We therefore identify the constituent dynamic capabilities that contribute to IS PPM. More detailed component dynamic capabilities enable practising managers to determine the detailed activities, costs and timescales incurred in their development and maintenance. A more detailed consideration also enables exploration of the differential distribution of the component capabilities across firms and helps managers understand how to develop IS PPM as a means of gaining competitive advantage.

Identification of the component capabilities also aids researchers to study how firms adapt IS PPM in turbulent market conditions. To date, research on the nature of dynamic capabilities has examined markets that are turbulent from rapid expansion (e.g., Drnevich and Kriauciunas, 2011; Koch, 2010). However, little is known about how dynamic capabilities change as a result of turbulence and uncertainty caused by recessionary conditions. As the global financial crisis of 2008–2009 and the subsequent prolonged global recession have demonstrated, firms need to adapt their IS PPM and other dynamic capabilities to meet, not just expansionary, but also recessionary conditions.

¹ **In this paper the term PPM is used to signify project portfolio management in non-IS contexts.**

Our study addresses the following two research questions: 1) *what are the constituent dynamic capabilities that contribute to IS PPM and how do firms develop these?* 2) *how do firms adapt the dynamic capabilities constituting IS PPM to match turbulent recessionary conditions?*

We begin with a review of prior literature on IS PPM, including its role in IS strategic planning. We then provide an overview of the dynamic capabilities literature, again emphasising studies undertaken in the IS and PPM domains. We next describe the case study method adopted for the study and present the findings using data drawn from the case studies. We conclude with a discussion of the findings and suggestions for further research.

2. Literature review

2.1. IS PPM

Several definitions of PPM exist, and though they are generally consistent, each emphasises a different aspect. For example, the US Project Management Institute (2008, p.8) emphasises the coordination across projects to meet strategic objectives: ‘a portfolio refers to a collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives.’ The UK Office of Government Commerce (2007, p. 3) adopts a more process perspective, stating that ‘[PPM] is a corporate, strategic level process for co-ordinating successful delivery across a firm’s entire set of programmes and projects.’ The National Audit Office (2006, p. 8) definition identifies the component activities of prioritisation, alignment and ability to deliver: ‘Prioritisation of all a

firm's projects and programmes in line with business objectives and matched to its capacity to deliver them.' We combine elements from all three definitions such as processes and component activities to produce the following definition: PPM are the processes and routines that allow co-ordination across an organization's programmes and projects to meet strategic business objectives and includes processes and routines relating to prioritisation, effective project management and resource allocation. In the above definition we do not follow the UK Office of Government Commerce's (2007) suggestion that PPM includes a firm's entire set of programmes and projects. This allows us to recognise that a firm may have more than one project portfolio and allows us to define IS PPM as: the processes and routines that allow co-ordination across an organization's IS programmes and projects to meet strategic business objectives. As stated in the introduction, programmes and projects in IS PPM may include only projects that are viewed as primarily IS projects by the organization, or they may also include other projects that have a significant IS component (e.g. change projects, new product or service projects) Both technical and social issues of the projects and programmes will be included in IS PPM. Our definitions support the premise of our study, that IS PPM is a collection of activities that encompass both routines and processes and therefore can be viewed as a set of dynamic capabilities.

PPM approaches have aspects in common with financial portfolio management, such as balancing risk and reward (Maizlish and Handler, 2005; Weill and Aral, 2006). Bardhan et al. (2004) describe how a variant of real options, used in managing financial portfolios, can help prioritise IS projects on the basis of the firm's overall strategy and the risks it is willing to take in the prevailing economic and market conditions. However, several differences make PPM particularly challenging

(Engwall and Jerbrandt, 2003; Kumar et al., 2008), including a lack of clear financial valuations of the underlying projects (Ashurst et al., 2008), greater constraints on certain resources (e.g., the availability of experienced project managers; Cooper et al., 1999), and the difficulty and costs of stopping ongoing projects for reasons that include ‘escalation of commitment’ (Keil, 1995). In the IS context, complexity increases because of the wide variety of project types (Weill and Aral, 2006), the difficulty of identifying and valuing many of the benefits (Ward et al., 2008), and the inability to accurately attribute both costs and benefits to specific investments (Jeffery and Leliveld, 2004).

As mentioned previously, IS PPM is recognised as an integral component of IS strategic planning. For example, Lederer and Sethi (1988, p. 446) explicitly use the term ‘portfolio’ in their definition of strategic planning for IS, which they describe as the ‘process of identifying a portfolio of computer-based applications that will assist a firm in executing its business plans and realizing its goals.’ Earl (1989, p. 86) argues that IS strategic plans should be treated as portfolios that ‘consider the trade-offs [of] risk and return ... and the allocation of IS resources.’ Since the 1980s, scholars have developed several portfolio management models (see Ward and Peppard, 2002, p. 301–305), most of which categorise IS investments and projects according to the nature of assets, resources or capabilities they create or their business impact and the risks involved, often expressed in terms of the business changes required.

Extant research has identified activities that contribute to IS PPM, including aligning projects to the organizational strategy (Reyck et al., 2005); balancing alignment, value and risk (Jeffery and Leliveld, 2004; Segars and Grover, 1998), identifying

dependencies between projects (Maizlish and Handler, 2005) and monitoring the performance of individual projects (Kumar et al., 2008). Jeffrey and Leliveld (2004) identify four levels of IS PPM maturity in organizations, ranging from ‘zero/ad hoc’ approaches, where organizations make decisions on projects in an uncoordinated way, through to ‘synchronized’ in which organizations align their IS PPM with their business strategy, balance project and portfolio risks and discontinue failing projects.

Segars et al. (1998) associate increased IS strategic planning effectiveness with a process approach they term ‘rational adaptation,’ which blends a formalised and structured approach with iterative and adaptive behaviours. They characterise rational adaptation as being associated with high levels of comprehensiveness, formalization and consistent application, a focus on control versus creativity and a top-down versus bottom-up planning flow. Whilst rational adaptation has been associated with IS planning effectiveness, extant studies have not applied the notion of rational adaptation to IS PPM.

More recently, studies have emphasised the need for IS strategy and planning to adapt to increasingly uncertain and dynamic environments (e.g., Merali et al., 2012), calling for approaches such as ambidexterity (Tushman and O’Reilly, 1996; He and Wong, 2004), adaptive (Merali, 2006), dynamic alignment (Oh and Pinsonneault, 2007) and co-evolutionary (Tanriverdi et al., 2010). Although these studies articulate the problems firms face in dynamic environments, they provide few examples of how dynamic adaptability or co-evolution can be achieved. For example, challenging Tanriverdi et al.’s (2010) argument to abandon the quest for alignment for the quest for co-evolution, Merali et al. (2012, p. 133) note that ‘this then raises the challenge

of selecting the dimensions for co-evolutionary fit for which they do not propose a solution.’ Similarly, Weill and Aral (2006) discuss the need to vary the criteria used in IS PPM decisions as business conditions and strategies evolve but offer limited advice on when to do so and no advice or examples of how changes can be made. With regard to when changes should be made, they suggest that organizations should do this when business and economic circumstances change or after improving their IS capabilities significantly.

2.2. Dynamic capabilities and IS PPM

The dynamic capabilities concept is rooted in the resource-based view of the firm (Barney, 1991; Doherty and Terry, 2009; Penrose, 1959; Wernerfelt, 1984). Some authors describe dynamic capabilities as processes (e.g., Cepeda and Vera, 2007; Chen et al., 2008), while others refer to them as routines (e.g., Pavlou and El Sawy, 2011; Winter, 2003). Eisenhardt and Martin (2000, p. 1107) combine both of these terms in their definition: ‘the firm's processes that use resources—specifically the processes to integrate, reconfigure, gain and release resources—to match and even create market change. Dynamic capabilities are therefore the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die.’ This use of both routines and processes suggests that though there are generally accepted differences between these terms (e.g., routines are learned and founded in tacit knowledge to a greater extent than processes; Becker et al., 2005; Davenport et al., 1996; Rerup and Feldman, 2011), dynamic capability scholars do not consider such differences significant.

Similarly, researchers find variation in the object of change, with some arguing that dynamic capabilities create or change the resources of the firm (Eisenhardt and Martin, 2000; Ward et al., 2005), others stating that they act to create or change the capabilities of the firm (Adner and Helfat, 2003; Helfat and Peteraf, 2009), and still others arguing that they operate on both (Cepeda and Vera, 2007; Wang and Ahmed, 2007). Resources and capabilities are distinct but related concepts; that is, the execution of capabilities usually requires certain resources, and in turn, the effective use of specific resources depends on certain capabilities. Hence to be effective, a dynamic capability is likely to be required to change both resources and related capabilities. Drawing on these critiques of extant definitions, we adopted the following definition of dynamic capabilities: ‘the firm's processes or routines that integrate, reconfigure, gain and release resources and related [ordinary] capabilities in order to create and match market, economic and environmental change.’

Table 1 provides evidence that extant studies in the IS domain have tended to identify dynamic capabilities at a high level of abstraction, for example, Wu (2006) identifies the following high level dynamic capabilities: resource integration capability, resource reconfiguration capability, learning capability and ability to respond to the rapidly changing environment. Killen (2008) has explored the area of innovation PPM, rather than IS PPM. She describes innovation PPM as a dynamic capability and is clear that it consists of multiple components, supporting our identification of the more detailed, constituent dynamic capabilities of IS PPM.

Take in Table 1 about here.

2.2.1 Dynamic capabilities under differing economic conditions

Studies of dynamic capabilities in expanding markets suggest that these capabilities become simpler, more experiential and fragile (Eisenhardt and Martin, 2000; Prigogine and Stengers, 1984). For example, in her study of e-marketplace development, Koch (2010) identifies three high level dynamic capabilities: digitized process reach, customer agility and entrepreneurial alertness. She describes that during the rapid expansion of these marketplaces the dynamic capability entrepreneurial alertness manifested as flexible, open-ended processes with high levels of local autonomy, such as: ‘do what it takes to secure business, a trial-and-error culture’ (p.35) and ‘negotiating long-term contracts’ (p.36). Similarly, Daniel and Wilson (2002) consider the development of dynamic capabilities developed by established firms moving online. The dynamic capabilities identified were specific to the activities studied, but displayed similar open-ended timescales and low levels of central direction as identified by Koch (2010).

To date studies have not explored how firms adapt their IS PPM dynamic capabilities in particular, and dynamic capabilities in general, in recessionary conditions. Our second research question explores the adaptation of IS PPM dynamic capabilities to meet turbulent recessionary conditions. To address this question, we draw on the notion of higher-order dynamic capabilities from strategic management literature (Cepeda and Vera, 2007; Collis, 1994; Drnevich and Kriauciunas, 2011; Heimeriks et al., 2012; Pavlou and El Sawy, 2011; Winter, 2003).

2.2.2 Higher-order dynamic capabilities

Ordinary or zero-order capabilities describe ‘how we earn our living now’ (Winter, 2003, p. 992). First-order dynamic capabilities are those that change ordinary capabilities and second-order capabilities change the first-order capabilities (Collis, 1994). Hence, if an example ordinary capability for a retailer is to operate their current stores or outlets, Winter (2003, p. 992) provides an example first-order capabilities as ‘the capabilities that support the creation of new outlets.’ Second-order capabilities are then changes to the way that those retailers have created new outlets in the past (Heimeriks et al., 2012; Zollo and Winter, 2002). Although in theory an infinite progression of orders of dynamic capabilities exists, each enabling change to the preceding lower order dynamic capability, Winter (2003) indicates that in practice firms are unlikely to sustain dynamic capabilities much beyond second-order capabilities. We provide a schematic of the relationship between the concepts of ordinary, first-order and higher-order dynamic capabilities that we used to guide the study in Figure 1. We have indicated the two research questions on the figure in order to show the relationships between the types of capabilities considered and the research questions.

Take in Figure 1 about here

Prior IS studies have not applied the notions of second- or higher-order dynamic capabilities, perhaps because they are difficult concepts. However, the importance of such capabilities lies in their ability to effect significant, even fundamental change to first-order capabilities to meet turbulent environmental conditions. Although first-order capabilities are associated with change, they are not intended to change themselves. For example, in turbulent conditions, deploying an existing first order

dynamic capability, such as the standard approach to new outlet development, may not be sufficient; rather, firms may need to adapt their current approach or adopt a completely new approach. Without the ability to develop second-order dynamic capabilities, first-order capabilities and their processes may well become fixed responses and effectively become core rigidities (Leonard-Barton, 1992).

Combining our earlier consideration of IS strategy with our discussion of dynamic capabilities, suggests that the changes that higher-order capabilities make to lower-order capabilities should closely align with the business strategy and, in the case of IS PPM capabilities, to the IS strategy. We also indicate by means of the two way arrows shown on Figure 1 that the changes to capabilities can occur in both directions. That is, consistent with the notion of realised and emergent strategy (Chan et al., 1997), realised changes to lower-order capabilities may in turn influence the development of higher-order capabilities. Finally, through the dynamic capabilities that we argue constitute IS PPM, firms may be able to realise the dynamic IS strategic alignment or co-evolution called for by studies in the IS field (Gable, 2010; Oh and Pinsonneault, 2007; Tanriverdi et al., 2010).

3. Research methods

To address our two research questions, we adopted a critical realist approach. Rather than the predictive approach associated with positivist approaches (Mingers, 2004), critical realism seeks to provide ‘empirically supported statements about causation, specifically how and why phenomenon occurred’ (Wynn and Williams, 2012, p.789), which is consistent with our research questions that seek to identify how firms develop and adapt their IS PPM dynamic capabilities. Whilst some have associated

critical realist studies with mixed method approaches (Mingers et al., 2013; Zachariadis et al., 2013), Wynn and Williams (2012) suggests that the case study is the ‘primary research design in this paradigm’ (p.803) as it allows the in-depth explication of the causal mechanisms in operation in specific contexts. These authors also discuss how multiple case studies and longitudinal studies can increase the confidence in the causative mechanisms identified by providing ‘empirical corroboration’ (p.801). As described below we therefore adopted a multiple case study approach, which considered the development and adaption of IS PPM over time.

3.1. Sampling and data collection

The sampling strategy we adopted for the study identified five case study firms (see Table 2) of different sizes and from distinct industry sectors. This variation in size and sector contributes to the analytical generalisation of the study (Benbasat et al., 1987; Yin, 2008). All are international firms with headquarters in the United Kingdom. A brief introduction to each of the case study organizations appears in Appendix A. We conducted interviews in 2009-2010, when the firms had experienced the turbulent economic conditions of the 2008-09 economic crisis and were continuing to experience the subsequent prolonged recessionary conditions. Two of the five firms studied included only projects they considered as primarily IS in their IS PPM, whilst the other three firms included both projects viewed as primarily IS and other projects that had significant IS components.

Take in Table 2 about here.

We interviewed multiple staff in the firms with varying roles in their firm's IS PPM (see Table 2). Data came from 30 semi-structured interviews, each of which lasted for one and a half hours on average. We asked interviewees when and why their firm had introduced or changed its approach to IS PPM, to describe the processes and routines put into place as part of IS PPM and how these compared with how the firm had previously selected, prioritised and monitored projects. Interviewees also discussed how they planned to develop their IS PPM activities over the next two years and what was driving their developments. Therefore, the data reflected three time points for each of the five cases: (1) before the introduction of IS PPM or changes to the IS PPM approach, (2) immediately after any changes and (3) planned adaptations for the next two years. We also collected and analysed other sources of data, such as internal documents (i.e., governance board portfolio reports and presentations, project briefs and business cases, implementation progress reports and internal memos) (Denzin and Lincoln, 1998).

The five case studies provided a balance between data overload and the analytical generalisation sought. In addition, the case studies demonstrated 'consistent regularities' during data analysis, indicating that this was an appropriate number of cases (Miles and Huberman, 1994).

3.2. Data analysis

We recorded and fully transcribed all interviews. We then aggregated the transcripts from each interview into case study summaries to gain a complete picture of the adoption, use and adaptation of IS PPM in each firm (Miles and Huberman, 1994).

We shared the case studies with the interviewees to ensure accuracy and increase the internal validity of the study.

A critical realist approach is associated with retrodution, in which causal mechanisms are proposed which 'if they existed would generate or cause that which is to be explained' (Mingers et al., 2013, p.797). In this study we proposed that dynamic capabilities are causal mechanisms. In order to provide further detail on the nature of the dynamic capabilities involved, that is to address our first research question, we coded the transcript data using tabular layouts in a word-processing package. We undertook coding in a two-step process: in the first step we identified processes or routines that matched our definition of dynamic capabilities and that appeared distinct from each other. In the second step, we labelled each of these possible dynamic capabilities with a code that described the activity. Thus whilst our overall logic was retroductive, this was operationalized firstly by a deductive coding step in which we assured we were identifying dynamic capabilities by matching with our definition. This was then followed by a second inductive step in which the codes (labels) given to the dynamic capabilities were derived from the data (Bryman, 2004). Appendix B provides an example of our coding approach. Following initial coding, we reduced the number of codes (possible component dynamic capabilities) by combining codes that appeared similar. We did this first within cases and then across cases. Logical grouping ceased after we had identified four codes (component dynamic capabilities) that appeared analytically distinct from one another.

To address coding bias and further improve the internal validity of the study, one member of the research team undertook coding, which the other two researchers then

independently assessed. Inter-coder reliability was high, and any differences were resolved through discussion. We compared the four dynamic capabilities with previous definitions of IS PPM to ensure that they covered the domain of IS PPM but did not extend beyond it.

To address our second research question, we tabulated and examined the nature of the developments that the case study firms had made, were making, or intended to make to their IS PPM activities over the next two years. We presented the four dynamic capabilities identified and the planned adaptations to those capabilities to a group of experienced IS PPM practitioners in a half-day workshop. These practitioners included, but were not limited to, case study participants. We asked the practitioners to comment on the completeness of the set and their face validity. Their comments provided indicative support for the study findings and supplied a degree of external validity.

4. Findings

We commence the reporting of our findings by describing how the case study firms first responded to the turbulent economic conditions of 2008-09. We then address our first research question by describing the four constituent IS PPM dynamic capabilities that were inductively identified from our data analysis. Finally we address our second research question by discussing how the firms planned to adapt their IS PPM to the ongoing recessionary conditions, which we interpret as examples of higher order capabilities in operation. At relevant points in the text we provide fuller examples from the case study firms in order to demonstrate some of the detail of how they

achieved the organizational changes necessary to either introduce or adapt their approach to IS PPM.

4.1. IS PPM adoption and adaptation to meet changing economic conditions

MediaCo and InsureCo adopted IS PPM in 2009 and 2008, respectively. The other three firms had undertaken some IS PPM-related activities before 2008 which they increasingly formalised after 2008. All interviewees agreed that the introduction of IS PPM or the change to their previous IS PPM activities was in response to the prevailing turbulent economic conditions.

The firms' approach to IS PPM included relevant infrastructure and application development projects (usually defined as projects above a certain investment value), and all the projects were subjected to a set of explicit and consistently applied processes (e.g., investment justification, project planning and management methodologies; Mignerat and Rivard, 2012; Wright and Capps, 2011). All the firms also identified having comprehensive governance mechanisms as critical to their new or revised IS PPM activities, which were geared towards gaining greater business ownership of IS projects, involvement and accountability in decision making and commitment to investment plans, as well as achieving greater benefits from the reduced funds and resources available in the recessionary environment. All firms had established new governance structures and processes. In all cases these included the formation of investment boards comprised of executive managers from both IT and business functions to oversee the IS PPM.

These investment boards were supported by project (or programme) management offices (PMOs) that collected and analysed the information on project status, updated the portfolio information and reported progress and issues to the boards. Research has previously identified this need to collate and compare information across projects as a pre-requisite for IS PPM governance (Reyck et al., 2005) and also as a driver of the adoption of consistent project management approaches across projects. For example, at the time of the study MediaCo was implementing an enterprise project management system in order to ensure consistency and ease of reporting across all projects. The system was underpinned by a new project management framework that had been mandated for all major projects, in order to ensure consistency in the management of projects.

InsureCo, ConsultCo and PharmaCo had established PMOs before 2008, but ServicesCo and MediaCo instigated a PMO when introducing the new IS PPM governance structures and processes. The project managers at ServicesCo were reorganised to be part of the PMO and were allocated to projects as needed. This was a deliberate move to increase control of the firm's resources by bringing them under the control of project managers that were formally part of the centralised PMO. It also meant that having a project manager allocated to a project was under the control of the PMO, which further increased control over projects. As we will describe with other changes related to IS PPM, there was some resistance to the centralisation of project managers. Business staff in ServicesCo felt it prevented them acting as project managers and hence developing the associated skills. Whilst the project managers that were moved into the PMO were initially pleased, since it raised their profile, they soon found they were asked to manage up to seven or eight projects

which resulted in excessive workloads. As time went on ServicesCo found that the centralised model was too restrictive and so allowed some staff outside of the PMO to act as project managers on smaller projects.

As an example of how firms had managed the changes involved in the introduction of IS PPM, the investment boards in all the firms, except in ConsultCo, were struggling to move from assessing and reviewing individual projects in detail to considering the implications of the overall investment portfolio. To address this the PMOs in MediaCo, PharmaCo and ServicesCo introduced, albeit quite different, portfolio models which categorised investments into different types and showed how resources were being deployed in relation to agreed priorities. An important part of these models was that they were highly visual and all involved positioning projects on a grid or set of axes that reflected the factors used to set priorities. The models were presented at the investment board meetings, often projected on a screen, so that the distribution of projects could be seen and encourage discussion of the distribution of projects and decision making at the portfolio, rather than project level. In the case of PharmaCo, use of a software package to generate the portfolio matrix allowed real time modification of project parameters in the investment board meetings in order to consider ‘what if’ options. Whilst interviewees reported that use of the shared portfolio matrices had helped elevate the discussion from individual projects to portfolio issues, there was still a strong tendency in ServicesCo and MediaCo for individuals at the investment board to spend time at the meetings discussing the issues of specific projects. PMO staff were addressing this by ensuring all project level issues had been dealt with or flagged before investment board meetings and by continuing to promote and use the portfolio matrices over time:

'the approach has been evolutionary due in part to taking time to gain traction with our decision makers...but now it is more familiar and accepted' (Financial Controller, ServicesCo).

All the case study firms identified the benefits they realised from the adoption of IS PPM. For example, MediaCo and InsureCo stated that IS PPM gave them greater visibility of all major project activities across the firm, which enabled them to anticipate and resolve resource issues before they arose and to reduce expenditures on external resources without affecting project plans. However, none of the firms formally assessed the benefits of IS PPM because they believed it was too difficult (many benefits are intangible) or would consume more resources.

4.2. What are the constituent dynamic capabilities that contribute to IS PPM and how do firms develop these?

Table 3 shows the four dynamic capabilities that contribute to IS PPM, identified from the study data, and those that each firm identified. Only ConsultCo demonstrated all four capabilities. The differential pattern of development supports the premise that IS PPM is a collection of inter-related dynamic capabilities, rather than a single, monolithic capability. The final column presents the rationale for how the dynamic capability satisfied the definition used in this study. We now discuss each constituent dynamic capability in turn.

Take in Table 3 about here.

4.2.1. Business objectives drive projects

All five firms described their wish to identify the ‘right’ projects as an important part of their rationale for introducing IS PPM, where right meant that the project was consistent with the strategic objectives of the firm and they were likely to be successful with it. None of the firms engaged in IS PPM simply to identify projects with the greatest financial return.

All the firms wanted to use their strategy as the starting point to identify projects. However this was only achieved by ServicesCo and ConsultCo. For example, the director of operations and finance at ServicesCo stated:

‘We have a very clear strategy in place that is revised annually. We are therefore starting from a clear position and so when projects are put forward they have arisen from an understanding of our strategy. For a proposed project to be included in the portfolio, a director must sign off on it, with explicit instruction on how it will help achieve one or more business objectives.’

In ConsultCo, projects were initiated from within strategic work streams that addressed achieving business objectives in the areas of new business acquisition, customer services, product and service innovations and economic and performance improvement.

In contrast, the three other firms post rationalised their choice of projects by relating them back to their strategy. One reason for this was that the strategies were often stated in high-level terms, resulting in a set of objectives with which the firms could justify a wide range of different projects. PharmaCo and InsureCo both defined longer-term strategic objectives, typically up to five years. This made it difficult for

them to identify the shorter-term priorities that were important in the turbulent economic environment. As the head of the corporate program office in InsureCo stated:

‘What is missing for me is: where is our focus over the next 12 months. Our strategy is set out in our five year plan.... But it’s very difficult for me to make prioritised decisions over the next 12 months.’

In an attempt to improve the linkages between projects and both business and IS strategies in MediaCo after 2008, all investment business cases included ‘strategy maps,’ which were diagrams that showed how the expected benefits from the project linked and contributed to the business objectives. For infrastructure projects, the maps also detailed how other application projects would be achieved with the new or enhanced infrastructure. Unfortunately this exacerbated tensions between the traditional newsprint business units and the online business:

‘It was definitely a case of he who shouts the loudest, gets what he wants and as that is also the biggest earner, the traditional business has always taken priority’ (Head of Programme Management).

The traditional businesses now found it relatively easy to use the maps to demonstrate cost savings, whilst for the online business it was more difficult to argue for funding to invest in more speculative projects to create new products and services, often involving new types of infrastructure. Inevitably the majority of IT funding and resources available was increasingly allocated to the traditional businesses to achieve short term cost savings. As yet this new approach had not achieved any significant improvement and they recognised they still did not use their strategy to drive projects.

For projects that are retrospectively aligned with strategy, it is more difficult to demonstrate that resource allocation was in response to evolving business conditions. Similar to Winter (2003), who differentiates ad hoc approaches from dynamic capabilities, we do not consider the post-rationalisation approach to alignment a dynamic capability. The interviewees also noted that post-rationalisation limited the effectiveness of their projects and their intention to move to their strategies driving projects. For example, the head of the corporate program office in InsureCo said:

'We have a sense that these projects are going to help us in our journey, but at the moment we don't know exactly what objective they are aligned to. This is changing.'

To address this issue, the firm initiated a new approval process that included a standard three-part business case (strategic, financial and scheduling). We provide further discussion of the process of introduction of the stratified business case and the reactions of staff in section 4.2.2.

4.2.2. Multiple and dynamic prioritisation criteria

All five firms were facing more severe resource constraints than before 2008, which demanded a more rigorous approach to project approval and prioritisation. While the most obvious limiting resource was the IS development capacity, all the firms' approaches recognised that other business resources constrained some projects. All five firms indicated that optimising the use of both business and IT resources was a critical reason for introducing IS PPM. In addition, all firms except InsureCo included other factors in the approval and prioritisation of investments and described how they varied the criteria used. They all reported placing greater emphasis on feasibility

criteria, such as project dependencies and risks, than on desirability criteria, such as return on investment, as recessionary conditions worsened.

As mentioned earlier, PharmaCo, MediaCo and ServicesCo had introduced and used portfolio models that initially classified projects into different types of investments before prioritising them within each category using different criteria. Decisions about priorities across the categories were made by the investment boards, largely subjectively, based on the extent to which the investments were contributing across the strategic objectives. The ServicesCo model included an initial classification by type of investment (strategic, high potential, operational, or support) and then a weighting system, based on financial, impact and risk factors, which determined the priority within each category. These weighting factors are set by the investment board and reviewed quarterly.

MediaCo classifies projects into four types: (1) revenue generation, (2) risk reduction/compliance, (3) infrastructure refresh/capability development and (4) cost reduction and avoidance. This categorisation allows the investment board to determine whether it has an appropriate spread of projects across the portfolio. From this assessment, the board adjusts its authorisation and prioritisation criteria to shift the pattern of investment to meet changing requirements. For example, interviewees described how a competitor had recently begun charging for online content. This was the first major UK-based media company to do so, and the announcement came as a surprise, causing MediaCo to adapt its prioritisation criteria to give greater emphasis to innovative online projects.

ConsultCo showed the most dynamic approach to using multiple criteria for appraising, prioritising and allocating resources. This was in part due to the rapid pace of developments in its industry as well as the large number of ongoing projects. From 2009–10 onwards, their investment strategy was largely centred on cost savings to match the recessionary conditions. The portfolio was intended to be self-financing: current projects should generate sufficient cost savings to provide the funds for new projects. Project priorities and resource allocations could be changed to increase the flow of financial savings, by postponing lower-return projects as better ones arose. The investment board that oversaw IS PPM met monthly, rather than quarterly, to ensure it could provide timely responses to changing conditions. The CEO described how review meetings adopted a dynamic approach to project review and prioritisation:

‘Questions that would be asked at these meetings were (1) is the scope of what we’re doing correct for our ambition? [and] (2) are there more things we should do, better things we should do, things that we should correct?’

InsureCo, in contrast to the other firms, was struggling to establish prioritisation criteria. It introduced stratified business case that separated the business, financial and scheduling aspects and it appears this was contributing to the inability to set priorities satisfactorily or vary the prioritisation criteria as the business environment changed. Whilst the strategic part of the case addressed our first component dynamic capability, the financial and scheduling parts were separated out in order to ensure each project had a satisfactory financial case and identified the main resources required and when they would be needed. These parts of the business case therefore should have given

InsureCo more than one perspective by which they could compare and prioritise projects. However, there was resentment from business managers in the organization to these stratified business cases, which undoubtedly required more work to prepare. Some of those interviewed suggested the reluctance was also because the separate evaluation of the three parts of the cases by both the PMO and the investment board meant it was harder to hide unattractive aspects of business cases.

At the same time as introducing the stratified business case, InsureCo reduced the cost threshold for projects to be submitted via the PMO to the investment board to £100K (from £250K). The intention was to increase IS PPM effectiveness by ensuring that the PMO and investment board had visibility of all the significant projects in the organization. Surprisingly, the immediate effect was actually a reduction in the number of projects included in the portfolio, rather than the increase expected. Interviewees initially thought that this was due to the weakness of the potential business cases, especially the lack of strategic contribution:

'I would suggest that the reason why they don't come through the central process is the requirement to produce a business case and justify what they are doing' (Head of Corporate Programme Office, InsureCo).

However an internal audit review of project budgets identified that after the change, staff were putting forward fewer than 50% of projects they were actually undertaking. In general, only those that required significant central IS department resources were being put forward as this was the only way to get such resources. Instead, staff classified many projects as 'local', only affecting one department, estimated their cost just under £100k and bought in external IS capabilities, in order to avoid having to

request central IS support. Staff also included projects in, or attached them to, major ‘strategic initiatives’ (such as initiatives to restructure the international businesses), which had already gained investment board approval, even though the projects were often only marginally relevant to the initiative.

The PMO manager proposed reducing the authorisation level still further, as a way of achieving the visibility the investment board wanted, but it was rejected by the board as they did not want to spend time on low cost investments or increase the resentment of staff due to reducing their budgetary discretion even more. The net result of these responses to the changes was that prioritisation was reduced effectively to scheduling new projects based on when the required IS department resources would become available.

4.2.3. Dynamic balancing of risk and reward

Across the five firms, the interviewees described that before the economic downturn, they considered risk only at the level of individual projects with little consideration of overall portfolio risk. Since the introduction or formalisation of IS PPM, they increasingly attempted to consider the risks across projects, such as project interdependencies and overall portfolio risk. However, only PharmaCo and ConsultCo showed clear evidence of balancing risk across the portfolio. The chief executive officer of ConsultCo summarised this approach:

‘I think what you need to do is manage your portfolio properly and have enough things going well that they outbalance the things going badly.’

PharmaCo includes potential future projects in the portfolio and compares the estimated value of new projects with those already under way. This was based on a scenario planning process introduced in 2009, which looked two to three years ahead to identify technology and resourcing options, within which an 18-month planning horizon is considered for project prioritisation. What-if analyses and quarterly reviews of the scenarios reduced the risk that commitments to current projects were preventing or postponing future projects with more potential.

Rather than measuring risk across the whole portfolio, MediaCo and InsureCo identified risks at a project level caused by project interdependencies and future contention for critical resources. For example, InsureCo identified risk to the success of projects when more than one project affected the same part of the firm simultaneously. This caused the firm to re-plan projects and reallocate resources so that the risk of disruption to operations was reduced. In both firms, as well as in ServicesCo, the PMO mandate included involvement in project and resource scheduling, and the firms were able to identify potential risks across projects, rather than just within them.

4.2.4. Cancel or reconfigure in-flight projects

Escalating commitments often make it difficult for firms to stop ongoing projects (Keil, 1995). As the chief information officer of MediaCo stated:

‘The ultimate test of effective IS PPM is killing poor projects and explaining why.’

All the firms agreed that IS PPM should help them identify and stop poor or failing projects. They also described how the IS PPM process included regular reviews of

ongoing projects, with the view to cancelling under-performing projects or, more often, projects deemed irrelevant to changing priorities.

In all the firms, potential projects go through several assessment and filtering processes before being presented to an investment board for approval and inclusion in the portfolio. Each firm had increased the rigour of this pre-approval scrutiny to prevent the inclusion of low-value investments and reduce the risk of escalating commitment to poor projects. For example, MediaCo introduced a new four-stage appraisal process, based on UK Office of Government Commerce (2007) guidelines. Project ideas were first discussed between the originator and the relevant business relationship manager, who acted as an intermediary between the business units and IS. If the project seemed worth pursuing, it was reviewed against other projects in the portfolio by the Demand Evaluation Forum (DEF), which was a group of business relationship managers drawn from across different business units. If the project was still deemed worthwhile, a full business case was developed and submitted to the business unit executive board for approval. All projects costing more than £50,000 had to go through this process. At the time of the study, as a short term response to the economic conditions, MediaCo had extended the role of the DEF to include a review of ongoing projects and to assess whether cancelling or postponing projects would increase the overall investment return in the next 12 months. As the IS PPM support manager commented:

‘The amount of money [we now have] for projects is significantly less.... In the past it felt as if every idea got authorised, but now it’s much more selective and we are only doing the important stuff.’

A key difference in ConsultCo and PharmaCo from 2008 was the use of ‘project health checks’ during the implementation phases of all major projects. The health checks involve revisiting the investment justification during implementation to ensure that the project still addresses the current strategic objectives, the project will deliver sufficient net benefits and no new risks have emerged to affect its feasibility. These two firms viewed this reassessment as particularly important in the turbulent business conditions, especially for longer duration, high-cost projects.

Interviewees confirmed that before 2008, projects were rarely cancelled, though some were allowed to die. Any reviews undertaken were post-implementation and therefore they could not identify failing or irrelevant projects until they had been completed. All the firms stated that since introducing the other activities involved in IS PPM, they were now able to cancel ‘in-flight’ projects and reallocate resources to others.

4.3. How do firms adapt the dynamic capabilities constituting IS PPM to match turbulent recessionary conditions?

To address our second research question, we considered how the firms had adapted, were adapting, or were planning to adapt their IS PPM activities over the subsequent two years. All the firms intended to further adapt the component dynamic capabilities constituting their IS PPM activities. They again indicated that the persisting difficult economic conditions were shaping the nature of the changes they intended to make to their IS PPM activities. Therefore, their plans provide insight into the adaptation of dynamic capabilities to match ongoing recessionary conditions and can be view as examples of higher-order dynamic capabilities. Table 4 presents the firms’ intentions

and plans for adapting their IS PPM capabilities, as well as the dynamic capability identified in Table 3 to which they are most closely aligned.

Overall, Table 4 demonstrates that the firms planned to change the component dynamic capabilities in an evolutionary way, making them increasingly detailed and analytical. Extending the role of the DEF in MediaCo is one such example. Both MediaCo and InsureCo introduced modified processes for investment appraisal to break large multi-year projects into phases, and though the investment board could approve the whole project in principle, they only released funds for the current phase (InsureCo) or the current financial year (MediaCo). Both firms also described how they planned to make the timing of budgeting cycles and portfolio reviews more consistent, to ensure that strategy and budget setting/review were completed before undertaking major project and portfolio reviews. Even ConsultCo, which showed evidence of all four component dynamic capabilities, indicated that it intended to change these in the future. For example, the firm described how it increased the frequency and rigour of the assessment of milestones through a new dashboard-reporting process, through which the executive team could review the status of all large projects on a weekly basis and also analyse the causes of variances to improve the accuracy of forecast use of resources on projects.

Take in Table 4 about here.

5. Discussion

The findings related to our first research question, that is the component dynamic capabilities identified that comprise IS PPM (shown in Table 3), are consistent with

Winter's (2003) characterisation of dynamic capabilities, that is they have a significant level of detail, take time and effort to develop and maintain and therefore have an associated cost, and are distinct from the approaches that the firms were using prior to 2008, which he would classify as 'ad hoc'. At the time of the study the firms had developed different combinations of the four component dynamic capabilities. ConsultCo was the only firm that demonstrated all four. The other firms had developed at least two of the dynamic capabilities and indicated that, in the subsequent two years, they intended to develop activities related to the other two. These findings suggest that IS PPM development is idiosyncratic and helps make such capabilities inimitable (Wernerfelt, 1984). The detailed development plans shown in Table 4 support the notion of an extended, incremental process (Winter, 2003) with high levels of path dependency and idiosyncrasy (Wernerfelt, 1984). The introduction and development in three of the case organizations of portfolio models to enable and encourage the investment boards to consider the overall pattern of investment is an example of an evolving and incremental process, which took several iterations to make effective.

The case study data and the four constituent dynamic capabilities suggest that the first dynamic capability: the ability of the firm to use strategic objectives as drivers of project investments, rather than post hoc alignment of projects back to the objectives, plays a unique role relative to the other three. Interviewees noted that they found it difficult to vary investment criteria, amend the balance of risk and reward, or stop or postpone projects, if the firm's strategy was unclear or if it was not well communicated. Whilst the first component dynamic capability identified appears to be an enabler of the other three, the overall effectiveness of IS PPM requires the

development and balanced interaction of all four component dynamic capabilities. For example, without the effective operation of the three latter component dynamic capabilities, there would be a risk of ‘escalation of commitment’ (Keil, 1995) if a firm ascribed the same priority to all projects.

The roles and activities performed by the PMOs in all the firms were evolving to become more consistent with the concept of ‘strategic PMOs’ (Desouza and Evaristo, 2006; Pellegrinelli and Garanga, 2009). The PMOs collated project information and increasingly advised the investment boards on the viability of projects and the implications of prioritised options and resource allocations. The ServicesCo PMO was responsible for all project scheduling and the PharmaCo PMO had sought to support organizational learning by instigating a ‘lessons learned’ process where findings from project health checks were transferred to other project sponsors and managers. Many of the intended future developments would extend the responsibilities of the PMOs further. However, some project managers resented the new aspects of the PMO roles because they perceived them as reducing their authority and discretion. For example, in InsureCo, some senior managers had challenged the value of the PMO compared to the costs and time involved. They considered the new control processes that had been brought in to standardise project management and project reporting were sufficient to improve project delivery and achieve IS PPM and they did not feel that what they perceived as additional ‘policing’ by the PMO was necessary or beneficial to their projects or the organization. Similar issues concerning the changing balance of PMO, project and business managers’ authority and influence were also expressed in MediaCo and PharmaCo, but interviewees considered many of these tensions arose as

much from the significant reduction and centralisation of IS resources that had occurred as a response to the economic conditions, as the introduction of IS PPM.

Regarding the links between IS strategy and planning and IS PPM, the four component dynamic capabilities identified and the planned changes shown in Table 4 are consistent with the characteristics given by Segars et al. (1998) for rationality, that is: they had high levels of comprehensiveness, formalization, participation, consistency and a focus on top-down versus bottom-up control. Our consideration of higher-order capabilities is also consistent with their use of the term adaptive. Measures of the effectiveness of the IS PPM of the case study organizations are beyond the scope of this study. However, it would appear that the firms are adopting IS PPM approaches that are consistent with the rationality and adaptation that Segars et al. (1998) associate with effective IS planning. Three of our dynamic capabilities are also consistent with Jeffrey and Leliveld's (2004) characterisation of the highest level of IS PPM maturity, synchronized: ongoing strategic alignment, balancing project and portfolio risks and weeding out underperforming initiatives (p.44).

Ideally, IS PPM helps firms allocate resources to both exploitation and exploration projects (March, 1991) representing a form of ambidexterity (Tushman and O'Reilly, 1996; He and Wong, 2004). However, in her study of new product project portfolios, Killen (2008) found that PPM resulted in an emphasis on shorter-term exploitation projects, at the expense of long-term exploration projects. Consistent with this, four of the firms reported that though it was not intentional, IS PPM had resulted in the approval of a greater proportion of short-term projects. This can be understood from our identification of component dynamic capabilities: shortening their strategy

formulation horizon (the first dynamic capability) because of economic turbulence coupled with the move to lower-risk projects of shorter duration (the third dynamic capability). For example, ServicesCo, whose annual planning and budgeting process initially drove IS PPM, moved to quarterly reappraisals in response to the economic conditions and, if judged necessary, projects were broken down into six-month phases for funding authorisation. The investment board only approved funds for the current financial year, resulting in smaller projects, tighter control of project costs and lower investment risks.

In considering our second research question, how do firms adapt the dynamic capabilities constituting PPM to match turbulent recessionary conditions, all the firms planned to further adapt their IS PPM approach. These adaptations were often to achieve closer synchronisation with business planning and budgeting processes, add more stringent control processes and increase the formalisation of activities (e.g., communication, monitoring, reporting), accompanied by redefined roles and authorities, especially for the PMO.

Previous studies suggest that dynamic capabilities in rapidly expanding markets become simpler, more experiential and fragile (Daniel and Wilson, 2002; Eisenhardt and Martin, 2000; Koch, 2010; Prigogine and Stengers, 1984). In contrast, our findings suggest that in turbulent, recessionary conditions, the dynamic capabilities constituting IS PPM become more detailed, are more centrally managed and consistently applied and reduce individual discretion. To move from this empirical observation to a contribution to the theory of IS PPM, it is necessary to consider possible explanatory mechanisms (Eisenhardt, 1989). Prior research on business

performance in recessionary conditions suggests that firms meet such conditions by reducing the acquisition of new resources, disposing of resources (e.g., downsizing, outsourcing) and focusing on making the most efficient use of the remaining resources (Evaristo et al., 2005; Kaplan and Sikes, 2009). Focus shifts from opportunity identification undertaken in expanding markets to the efficient use and tight control of the reduced pool of resources (Eisenhardt, 1985), and emphasis moves from experimentation to the reduction of risks (Levinthal and March, 1993), particularly those associated with the waste of limited resources. This usually involves increasing the level of reporting detail and the analytical nature of control processes and ensuring that they are applied widely and consistently, which in turn reduces the opportunity for individual discretion. A focus on control processes to increase efficiency and reduce resource wastage is also associated with greater centralisation of activities (Herbert, 2009; Ward et al., 2005).

Although our empirical study focusses on IS PPM, we suggest that dynamic capabilities in areas other than IS PPM are likely to become increasingly detailed, analytical and consistently applied in recessionary conditions. Our study therefore suggests that the boundary conditions of dynamic capabilities in recessionary and expansionary economic conditions are distinct. Previous studies have not recognised this difference.

6. Implications for Practice

As discussed earlier IS PPM is an integral element of many organizations' IS strategic planning and management approaches and it can be argued that it is a practice-led

aspect of IS strategy (Ward, 2012). Given IS PPM's extended use, there have been few research studies of the constituent practices or activities, their effectiveness or how they are adapted as business conditions change. Additionally the study addresses an issue of concern in the relevance or usefulness of much IS research. Peppard et al. (2014) argue that research of practical relevance is more likely to draw on detailed study of situated practices, such as the capability development considered in this study, than more abstract consideration of macro issues across firms.

This research has identified the dynamic capabilities constituting IS PPM, and how the case study firms developed those capabilities, at a level of detail that is instructive for practising managers. It highlights the timescales and investments associated with both developing capabilities and adapting them to ongoing recessionary conditions. All the case study firms suggested that they had realised benefits from IS PPM, including greater visibility of project activities; fewer failed, delayed, or overspent projects and the ability to anticipate and resolve resource issues before they arose. However, none of the firms formally quantified the benefits of IS PPM and as a result they could not identify an appropriate level of investment of staff time and other resources in the development and maintenance of their IS PPM dynamic capabilities. As mentioned previously, in one case some managers questioned the value of IS PPM relative to the effort involved and argued for a reduction in the level of reporting and scrutiny involved in IS PPM.

Finally, managers should recognise that IS PPM may result in an emphasis on shorter-term exploitation rather than longer-term exploration projects (Killen, 2008). By using classifications of project types and portfolio models and prioritising within and across

these project types, some of the firms were able to assess whether the exploration/exploitation balance was appropriate. For example, through categorisation, MediaCo was able to adapt prioritisation criteria so that a certain number of exploratory online projects could be undertaken, even when the main priority was to reduce both business and IT costs.

7. Conclusions and Future Research

Developing IS PPM dynamic capabilities is an important means of achieving and sustaining dynamic IS strategic alignment (Gable, 2010; Merali et al., 2012; Tanriverdi et al., 2010) and is therefore a key component of IS strategy development and implementation. Sustaining that alignment in rapidly evolving or uncertain business conditions depends on agile or responsive management decision making in terms of identifying and prioritizing investment opportunities, based on effectively ‘fusing IS and business knowledge’ (Peppard and Ward, 2004). IS PPM is a mechanism for enabling that fusion of knowledge, but depends on component capabilities to achieve both agility and sustainability. This research demonstrates that the five case study firms introduced IS PPM, or formalised their existing IS PPM approach as a response to the turbulent financial conditions of 2008-09. It identifies the component dynamic capabilities that comprise IS PPM and discusses how the case study firms planned to adapt those capabilities to match continuing recessionary conditions.

Future studies should continue our longitudinal approach, for example, in order to study how adaptations firms make to their IS PPM in certain economic conditions

evolve as those conditions change. Such studies would provide a dynamic view of dynamic capabilities allowing a study of how they achieve change to underlying resources and capabilities. Such a dynamic view is missing in studies of dynamic capabilities to date, since most tend to be cross-sectional in nature. We also recognise that whilst our study of five organizations provides a degree of generalizability, which we believe is important at this early stage of the study of IS PPM dynamic capabilities, reporting findings from five case studies reduces the detail that can be provided about any individual case. Reporting such detail can explicate the extended and path dependent processes involved in establishing and adapting IS PPM, including stakeholder perspectives, resistances, affordances and negotiations.

This study contributes to the academic understanding and practical application of IS PPM by identifying four constituent dynamic capabilities. The component dynamic capabilities enable managers to adopt sequences and combinations of developments that are most suited to their existing circumstances, the changes needed and the resources available. Our study suggests that the first dynamic capability, business objectives drive projects, enables managers to most effectively deploy the other three dynamic capabilities identified. However, as evidenced by the intention of all case study firms to develop all four component dynamic capabilities, each of the component capabilities makes an important contribution to the overall effectiveness of IS PPM.

This study also provides unique empirical evidence of how firms adapt their dynamic capabilities associated with IS PPM to match continuing recessionary conditions. We show that the component dynamic capabilities become more detailed, highly analytic,

more centralised and more consistently applied and we explain these findings as a manifestation of the move by firms to increase central control over resources and their allocation in times of resource scarcity. The findings of how dynamic capabilities change in recessionary conditions provide an important contribution to the boundary conditions of IS PPM and possibly of dynamic capabilities more generally (Zollo and Winter, 2002). We also introduced higher-order dynamic capabilities (Collis, 1994; Heimeriks et al., 2012; Winter, 2003), which, to our knowledge, do not appear in extant studies in the IS field. Finally, in response to expressed concerns in prior research of the abstract and generic nature of dynamic capabilities (e.g., Ambrosini and Bowman, 2009; Easterby-Smith et al., 2009), this study provides examples of dynamic capabilities specific to IS PPM and examples of their development and use to respond to the prevailing recessionary economic conditions.

Although not the aim of this research, our study is consistent with the emerging field of strategy-as-practice in that we have studied the activities (praxis) performed by practitioners using and evolving dynamic capabilities (practices) and the consequent outcomes. In his recent paper Whittington (2014) argues that closer working between IS and strategy-as-practice researchers would be mutually beneficial. He suggests IS strategizing is more practice based, often more tangible and accessible than business strategizing, whereas IS strategy research could benefit from studies using a new research lens, which provides a 'deepening' of understanding. We believe the topic of IS PPM is one where these mutual benefits could be readily be achieved leading to new insights for both research streams.

Acknowledgements

The authors thank the Chartered Institute of Management Accountants, which funded this work. They also thank the managers who participated in this study for giving their time and sharing their experiences.

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Table 1: Examples of dynamic capabilities in extant literature (strategic management, IS and PPM domains).

Example capabilities	Authors	Domain / nature of study
Product development, alliancing, strategic decision-making, knowledge creation	Eisenhardt and Martin, 2000	Strategic management / Theoretical
Use of IT to develop a new product or service, develop a new business process, create new customer relationships or change ways of doing business	Drnevich and Kriauciunas, 2011	IT / Small-scale survey
Demand management, creating marketing knowledge, building brands, customer relationship management	Maklan and Knox, 2007	IT/ Action research
Resource integration, resource reconfiguration, resource acquisition and elimination	Chen et al., 2008	IT / Single longitudinal case study
Sensing the environment, learning, coordinating and integrating	Pavlou and El Sawy, 2011	IT / Survey
Resource integration capability, resource reconfiguration capability, learning capability, ability to respond to the rapidly changing environment	Wu, 2006	IT / Survey
Knowledge exploration, knowledge exploitation, focus	Bhatt and Grover, 2005	IT/ Survey
Example dynamic capabilities: A rapid cycle of strategy development and implementation. Incorporating substantial alterations to the business model with uncertain information. Iterative development of customer value propositions	Daniel and Wilson, 2003	IT/Qualitative case studies
Innovation PPM	Killen, 2008; Killen and Hunt , 2010	PPM / Mixed method – quantitative survey and qualitative multiple case studies
Digitized process reach, customer agility, entrepreneurial alertness (related to E-marketplace development/launch)	Koch (2010)	Two qualitative case studies

Table 2: Case study firms and interviewees

Case Name	Industry	No of employees	Projects included in PPM	No of interviewees	Interviewee Roles
MediaCo	News and media	6,000	IS	7	CIO, Head of Change Management, PMO Manager, Finance Manager, Business Relationship and Programme Managers (3)
ServicesCo	Professional services	300	IS and Business	6	Executive Director Operations and Finance, Head of Programme Management, Strategic Planning Manager, Financial Controller, Programme and Project Managers (2)
InsureCo	Insurance	700	IS and Business	4	Head of Corporate Programme Office, Corporate Strategy Analyst, PMO Manager, Senior Project Manager
PharmaCo	Pharmaceuticals (R&D)	110,000	IS	7	PMO Manager, IT Portfolio Manager, IT Finance Manager, Business Project Manager, Business Analyst, IT Project & Programme Managers (2)
ConsultCo	Business and technology services	40,000	IS and Business	6	CFO, CEO UK, Sales Director, Strategy Director Netherlands, Integration and Change Programme Director, Managing Consultant
Total				30	

Table 3: IS PPM dynamic capabilities

	Dynamic capabilities	Cases in which capability observed*	Fit with dynamic capability definition (see section 2.2)
1	<p>Business objectives drive projects</p> <p><i>The ability to use the organization’s strategic objectives as explicit drivers of project investments, rather than select investments by post hoc alignment back to the objectives</i></p>	ServicesCo ConsultCo	Projects use resources and ordinary capabilities to produce new assets, resources and capabilities required to achieve business objectives. As business conditions evolve the business and IS strategies will change and affect the criteria used in identifying and selecting new projects.
2	<p>Multiple and dynamic prioritisation criteria</p> <p><i>The ability to use multiple criteria in the appraisal and prioritisation of investments and vary those criteria over time as business conditions change.</i></p>	MediaCo ServicesCo PharmaCo ConsultCo	Project prioritisation and resource allocation must be based on criteria that accommodate projects that make different types of contributions (e.g., compliance, innovation). Prioritisation criteria must change to allow for changing business, IS and strategies, project performance and resource availability.
3	<p>Dynamic balancing of risk and reward</p> <p><i>The ability to identify and balance reward and risk at both project and portfolio levels and adjust the project selection criteria to maintain a level of portfolio risk that reflects economic conditions.</i></p>	MediaCo InsureCo PharmaCo ConsultCo	Balancing risk and reward requires that resources are allocated or reallocated to achieve the portfolio contribution. Both the potential rewards and risks will evolve as the business environment changes and as the projects progress.
4	<p>Cancel or reconfigure in-flight projects</p> <p><i>The ability to stop, postpone, or reconfigure projects, including ‘in-flight’ projects, as their actual or relative value to the organization changes and to reallocate the resources to other projects.</i></p>	All	Cancelling or postponing projects releases resources. It also reverses resource allocation decisions previously made. The criteria used to cancel and postpone projects will vary with business conditions, project performance and potential alternative investments that can use the released resources.

*Capability was provided by the case study informants.

Table 4: IS PPM developments: plans and processes

	Dynamic Capabilities	Stated intentions for adaptations to IS PPM dynamic capabilities and constituent processes
1	Business objectives drive projects	<ul style="list-style-type: none"> - Clear and specific strategic objectives with identifiable commitment to them from senior managers in both words and deeds (InsureCo & PharmaCo) - Consistent communication of firm-wide objectives and performance against them and regular review to ensure continued relevance to changing conditions and progress made (MediaCo, ServicesCo, InsureCo) - Formal recording and review of how all projects contribute to objectives (all firms) - Consistent planning horizons and timing between strategy and budgeting cycles and project and portfolio reviews (MediaCo & InsureCo) - Need to assess combined impact of projects in the portfolio on meeting each objective and gaps where actions needed to achieve objectives (MediaCo, PharmaCo)
2	Multiple and dynamic prioritisation criteria	<ul style="list-style-type: none"> - Ability to identify and apply consistent, relevant multiple factors to all types of projects to allow comparison and prioritisation on a combination of <i>desirability</i> factors (e.g., strategic fit, benefits, expected financial return, compliance) and <i>feasibility</i> factors (e.g., technology, resource and skills availability, dependencies) (all firms) - Explicit statement and communication of prioritisation criteria and ‘rules’ and consistent application (MediaCo, InsureCo, PharmaCo) - Mechanism for reviewing and varying criteria to reflect changing business conditions (ServicesCo & InsureCo), including ability to identify, monitor and react to leading indicators (ConsultCo)
3	Dynamic balancing of risk and reward	<ul style="list-style-type: none"> - More accurate, evidence-based estimates of benefits included in business cases (MediaCo, ServicesCo, InsureCo) - Detailed risk assessment for each project to identify the probability of the stated benefits being achieved and reliability of resource and time estimates (MediaCo, ServicesCo, InsureCo) - Identification of overall investment risks at a portfolio level and ability to identify ways of changing plans to improve overall reward/risk ratio (InsureCo & PharmaCo) - Identify interactions between projects in the portfolio to determine effect on risk, including critical resource constraints and consequences of individual project failure (MediaCo, InsureCo, PharmaCo, ConsultCo)
4	Cancel/reconfigure in-flight projects	<ul style="list-style-type: none"> - Setting of detailed milestones for all projects and timely, accurate and complete reporting on progress and actual and forecast resource use on all projects (PharmaCo & ConsultCo) - Stage-cost approvals given: funding is approved for each stage of a project rather than for the whole project (MediaCo) to prevent resources being allocated to low-value projects (MediaCo, ServicesCo, InsureCo) - Ability to compare relative values of current and new projects even though estimate information is not of similar quality (ServicesCo & InsureCo) - Defined authority to stop in-flight projects or cancel planned projects (MediaCo, InsureCo & PharmaCo) - Project health checks for all ongoing projects, including a review of strategic fit and value of the expected benefits and identification of any emergent risks (MediaCo & InsureCo)

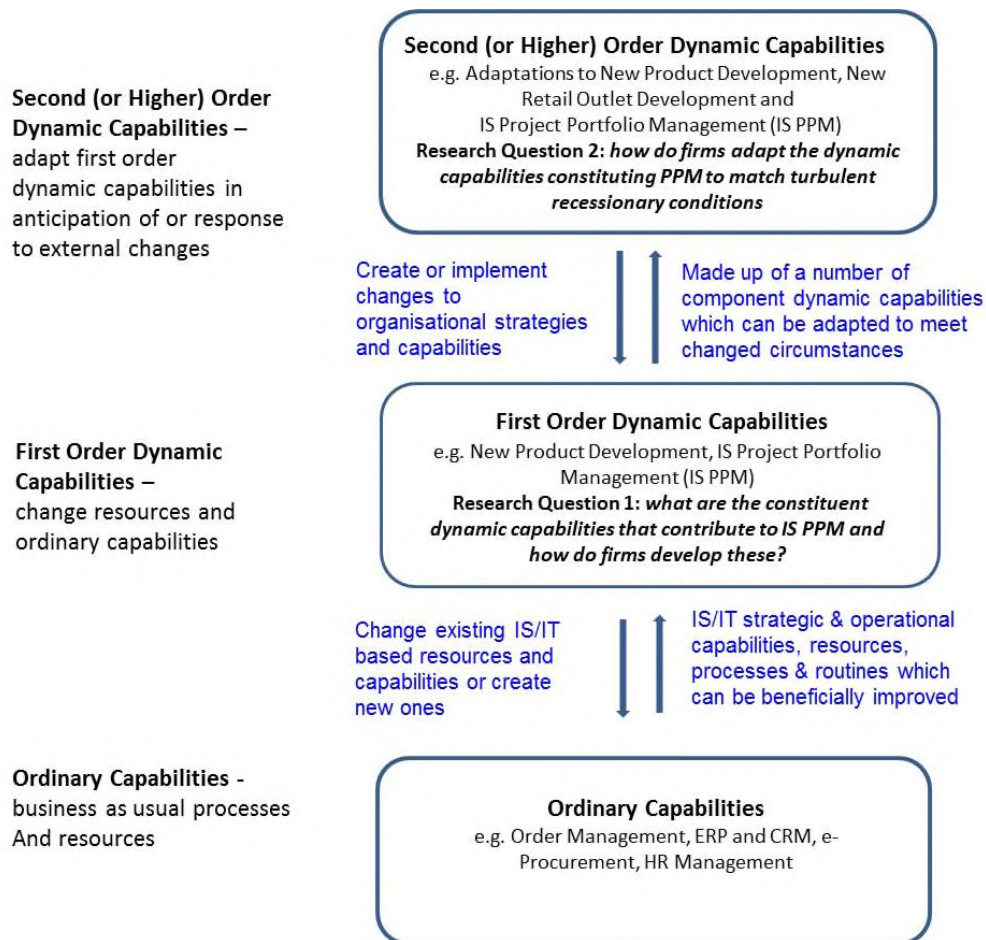


Figure 1. Capabilities typology used to guide study.

Appendix A. Introduction to the case study organizations

This appendix provides a brief introduction to the five case study organizations. InsureCo and ServicesCo are medium sized organizations (less than 1,000 employees) with operations in both the UK and overseas. The others are major multinational organizations with operations across the world and employ between 10,000 and 50,000 people. All five organizations have centralised IS departments and additional IS specialists within their major units and geographical locations, though these were being reduced in all the organizations. The number of IS specialists ranged from under 30 to over 600 (including contractors) and the annual investment budgets for IS projects ranged from £2 million to over £50 million, at the time of the study. The case study organizations are from distinct industry sectors, as described below.

InsureCo is a medium-sized niche insurer specialising in personal insurance and pensions as well as property insurance for non-commercial properties. It is based in the UK but has operations overseas, most notably in Australia. It is investing heavily in new customer relationship processes and systems to protect its customer base and new online channels and delivery services to gain new customers.

ServicesCo is the membership organization of a major professional body. It provides educational and accreditation services to support students taking its professional qualifications, as well as continuing professional development for members. It has approximately 300,000 professional members worldwide. Members are increasingly demanding additional benefits and services and the organization wishes to continue its global expansion.

MediaCo is one of the leading publishers of national and regional newspapers in the United Kingdom and in a number of overseas territories and has a rapidly expanding online presence. It is under pressure to reduce costs and rationalise its processes across the newspaper publications while also investing in its online news and associated resources to maintain its competitive position.

PharmaCo is one of the largest pharmaceutical companies in the world, which, along with its competitors, is facing increased regulation in a market in which returns on new products are decreasing. The emphasis of the strategy in the R&D division is on reducing research costs through standardisation of processes while reducing time to market and risks in product development.

ConsultCo was formed during the 2000s from the mergers of four IT consulting companies from across Europe. It provides IT-related outsourcing, development and consultancy services worldwide. It was heavily dependent on public sector revenues when the financial crisis hit these declined substantially. To address this it has reduced costs in its supply chain and reconfigured its marketing and sales structure in order to develop and serve other market sectors.

Appendix B. Example of coding method

As described in the Research Methods section, our coding had two steps (shown in the two columns on the right in the table below). In the first step we identified processes or routines that matched our definition of a dynamic capability. In the second step we labelled these with a code that described the activity. Hence the nature of the dynamic capabilities identified (wording of the codes) was derived from the study data.

Interviewee response	Meets two criteria of our definition of dynamic capability a) A management process or routine b) Causes a change to underlying resources or capabilities	Code given to reflect nature of dynamic capability
<p><i>'For 2010 we were just going through the initiatives we're thinking of doing. First of all, we categorised them by whether they're strategic, speculative, operational or support because what we don't want to be doing is all strategic projects. We need a balance. And we don't want to be doing all key operational or we don't move forward. We've then got a list of criteria for 2010.'</i></p> <p>(Strategic Planning Support Manager, ServicesCo)</p>	<p>a) 'we categorised' and indicates a management process to (re)organise resources</p> <p>b) 'we don't want to be doing is all strategic projects. We need a balance' and 'We've then got a list of criteria for 2010' indicates balancing resource configurations to meet the business environment at that particular time</p>	<p>c) 'strategic, speculative, operational or support' suggests Ability to prioritise projects, ability to include multiple criteria in the prioritisation of projects.</p>
<p><i>So the investment board met recently to classify our in-flight top 20 projects by – revenue generating, cost avoidance, capability development or compliance based. They found that very interesting to see the balance of activity....given the nature of things and the credit crunch we've had to realign our costs with our revenue models...</i></p> <p>(Head of Programme Management, MediaCo)</p>	<p>a) 'the investment board classified' and indicates a management process to (re)organise resources</p> <p>b) 'given the nature of things and the credit crunch we've had to realign our costs with our revenue models' indicates balancing resource configurations to meet the business environment at that particular time</p>	<p>c) 'revenue generating, cost avoidance, capability development or compliance based' suggests Ability to prioritise projects, ability to include multiple criteria in the prioritisation of projects.</p>