

# Resource Orchestration for IT-enabled Innovation<sup>1)</sup>

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## **Abstract**

This conceptual article addresses the question: how do firms convert IT resources into IT capabilities and IT dynamic capabilities for innovation? The extant literature on IT capabilities has few studies that attempt to explain “how” IT resources are acquired, exploited, or manipulated in order to support IT capabilities and IT dynamic capabilities. Using a comprehensive literature review, and the theoretical lens of Resource Orchestration Theory, this article addresses this gap. We demonstrate that firms use the processes of structuring, bundling, and leveraging to convert IT resources into IT capabilities, and IT capabilities into IT dynamic capabilities. We show how firms are able to “orchestrate” IT resources and IT capabilities to innovate and create competitive advantages, even in the face of environmental turbulence which introduces uncertainties that affect the orchestration process.

The article has value for academics and practitioners. For academics, it opens up the black box of the relationships among IT resources, IT capabilities, and IT-enabled dynamic capabilities using Resource Orchestration Theory. It identifies new opportunities to apply this theory and to conduct further research. For practitioners, the article provides insights regarding the use of IT resources and the development of IT capabilities to enhance innovation and firm performance.

**Keywords:** *Resource Orchestration, Resource-based View (RBV), IT Capabilities, Dynamic Capabilities, Environmental Turbulence, Innovation*

## **INTRODUCTION**

Sony Corporation of Japan was a leading electronics and consumer goods giant until the mid-1990s. Around the same time, Samsung Electronics of South Korea was a small but growing competitor, especially in the personal electronics space. Sony had, at its disposal, a large R&D division, a global distribution network, and ready access to high

quality technical and managerial human resources of Japan (Xu and Muneyoshi, 2016). Comparatively, Samsung was a smaller organization and did not have access to either similar quality or quantity of resources. However, leveraging the resources at its disposal in a strategic manner, Samsung quickly shifted its goal of challenging Sony for dominance in consumer electronics to surpassing Sony as the global leader in consumer electronics. In order to

achieve its goal, Samsung reconfigured and reorganized the resources at its disposal to be efficient, innovative, and agile. It quickly embarked on a mission to develop and orchestrate capabilities that enable adaptation to rapidly changing consumer preferences around the world, focusing particularly on growth-oriented emerging markets (Kim, 1997).

Samsung developed organizational dynamic capabilities to orchestrate simultaneous competition and cooperation within the various business units in its ecosystem, thus enabling innovation of emerging technologies and outplaying its competitors (Song, Lee, and Khanna, 2016). Dynamic capabilities are defined as “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece, Pisano, and Shuen, 1997). Due partly to its dynamic capabilities, today Samsung is competing with Apple for global leadership in manufacturing and sales of smartphones, tablets, and many other consumer electronics, while Sony is struggling to survive in this race. This scenario raises intriguing questions about how Samsung developed these new capabilities by reorganizing and reconfiguring its existing resources and how it gained a competitive advantage over an incumbent rival.

While it is true that Samsung relied, to a large extent, on its physical resources and capabilities to improve its business performance, it is also true that augmentation from digital and IT-enabled capabilities drove much of the competitive advantage that Samsung was able to garner from its purely physical resources. Additionally, Samsung was able to create digital resources and capabilities in combination with its physical resources and capabilities, leading to better management and exploitation of resources as well as adapting to changes in the competitive landscape, especially during the economic crisis of 1996–1997.

Following from the example above, in this article, we examine how firms are able to orchestrate IT resources into IT capabilities. Furthermore, we also examine how, when faced with an increasingly uncertain or turbulent business environment, firms convert IT resources and capabilities into dynamic IT capabilities. From a theoretical perspective, the conversion of firm resources into capabilities and

dynamic capabilities has already been addressed by the resource-based view (RBV) of the firm (Barney, 1991) as well as by the dynamic capabilities arguments of Eisenhardt and Martin (2000) and other prominent researchers. However, the literature provides only limited answers to the resource orchestration question, especially given the advent of new digital technologies and a globally competitive landscape. In an age of disruption, it is very important for an organization to know how it can maximize value by creating new product and service capabilities by reconfiguring and combining existing resources and capabilities, thus building new, more valuable capabilities in a dynamic and uncertain business environment. Although we know much about innovation processes and innovation cycles, more research is needed to understand how firms orchestrate their resources to create innovation (Carnes et al., 2016).

We begin our enquiry by looking into how the literature describes the possession of resources by organizations. The Resource Based View (RBV) of the firm is a well-established and extensively used theory in the field of strategic management (Barney, 1991). RBV posits that firms possess and exploit resources to gain competitive advantage (Barney, 2001). Nonetheless, over the years, critics have challenged the RBV of the firm. Previous studies have raised concerns regarding its usefulness due to its claim that “resources” are a primary basis for gaining, and sometimes sustaining, competitive advantage (Priem & Butler, 2001a, 2001b). There have been criticisms centered around the focus of RBV on “resources” while ignoring the role of the manager, the firm’s contextual understanding, its network and social connections that influence decision making, and its constantly changing external business environment (Arend & Bromiley, 2009). The RBV has also been criticized for being too inclusive in its definition of what a resource is; how the value of a resource is determined; whether rarity has been correctly parameterized; and the extent to which it applies in dynamic environments.

Defending the RBV, Barney (2001) has responded to these criticisms by suggesting that aspects of RBV must be used together with the five forces model (Porter, 1980), to address changing internal and external threats and opportunities.

Furthermore, Helfat and Peteraf (2009) have argued that competitive advantage in the RBV framework stems from several organizational functions that involve multiple levels of analysis, from managerial decision-processes, to organizational routines, to competitive interactions and environmental change. Hence, studies that utilize the RBV framework must take into account various organizational and contextual factors.

This article examines RBV in the information technology/systems (IT/IS) context. Several IT/IS studies show that IT resources can be used to increase firm innovation and other aspects of firm performance (Bharadwaj, 2000; Rivard, Raymond & Verreault, 2006; Wade & Hulland, 2004). Similarly, several IT-related studies have shown how firms develop capabilities based on strategic exploitation of their IT resources (Duhan, Levy & Powell, 2001; Peppard & Ward, 2004). Furthermore, other studies point towards dynamic capabilities (Eisenhardt & Martin, 2000; Teece, 2007) for sustained competitive advantage and as drivers of firm performance (Kim et al., 2011; Park & El Sawy, 2013; Piccoli & Ives, 2005).

Logical links exist between IT resources, capabilities, dynamic capabilities, and firm innovation and performance. These constructs often form a chain or pipeline—starting with IT resources, leading to firm competencies or capabilities, and in dynamic environments, further leading to dynamic capabilities. However, few studies provide explanations regarding “how” this linkage occurs (Fink, 2011; Kim et al., 2011; Wang et al., 2012). Furthermore, studies that focus on competitive advantage driven by IT resources and IT capabilities have received criticism (Carr, 2004). The criticism points to the fact that “commoditization” of IT has led to diminishing levels of competitive advantage, especially in dynamic environments (Chae, Koh & Prybutok, 2014), and IT resources and capabilities have become less important factors for innovation. Nonetheless, several critical studies do acknowledge the role of dynamic capabilities, supported by IT capabilities, in providing competitive advantage to organizations in turbulent or highly competitive business environments (Chae, Koh & Prybutok, 2014). Even in the extant literature on dynamic capabilities, debates and criticisms exist

regarding the definition of what exactly dynamic capabilities are, how they are defined, what their organizational and strategic impacts are, and how firms can leverage dynamic capabilities for sustained competitive advantage (Eisenhardt and Martin, 2000; Teece, 2007; Easterby-Smith, Lyles, and Peteraf, 2009).

From the point of view of fostering innovation, the extant literature has largely focused on the amount of resources needed to develop innovation or on the effect of specific resources on innovation, but relatively little attention has been paid to how managers actually orchestrate those resources for innovation (Carnes et al., 2016). While many studies exhibit nomological networks showing causal linkages among IT resources, IT capabilities, IT-enabled organizational dynamic capabilities, and innovation, they only partially answer a question regarding the process of “how” organizations drive innovation and performance using IT resources and capabilities. As a potential answer to this question, our article examines the process of “IT resource orchestration” in order to explain how IT capabilities and dynamic capabilities are created by exploiting the IT resources at the disposal of the organization. We use the theoretical foundation of resource orchestration theory (ROT), which states that resources must be structured, bundled, and then leveraged in order to gain competitive advantage (Sirmon, Hitt & Ireland, 2007).

Furthermore, ROT extends RBV and addresses some of its criticisms, specifically regarding the role of the manager in managing the resource portfolio (Daneels, 2008, 2010) and converting the resource base into valuable competencies or capabilities (Sirmon et al., 2011). Although ROT focuses on “resource” orchestration, this article uses an IT/IS context to extend the discussions specifically to IT resources, thereby using the term “IT resource orchestration”. By relying on previous studies that have used second-order IT and organizational capabilities (Park & El Sawy, 2013; Pavlou & El Sawy, 2006) to describe dynamic capabilities, we also introduce the idea of “IT capabilities orchestration”. IT capabilities orchestration enables the conversion of IT capabilities into dynamic capabilities to enhance innovation, efficiency, and firm performance. We answer the question: how do firms convert IT

resources into IT capabilities and dynamic capabilities to drive innovation and firm performance?

Next, we provide the theoretical foundations to support our arguments. We then provide an explanation regarding the process of orchestration and conversion of resources into capabilities and dynamic capabilities, and discuss how the external business environment may influence this process. Finally, we provide propositions and highlight our contributions.

## THEORETICAL FOUNDATIONS

### *IT Resources and Capabilities*

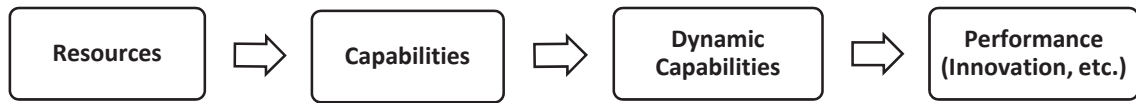
In the extant literature on IT-enabled innovation, several studies use RBV and dynamic capabilities as theoretical foundations (Bharadwaj, 2000; Pavlou & El Sawy, 2010; Wang et al., 2012). These studies tend to use a process-based model to interrelate IT resources, capabilities, core competencies, and firm performance (Ravichandran & Lertwongsatien, 2005). Resources are categorized as technological, human, and partnership-based, and lead to capability development in a firm (Ravichandran & Lertwongsatien, 2005). Such a categorization shows that IT capability is built on an underlying set of diverse resources that go beyond technological resources alone. To provide a temporary competitive advantage, these resources must possess “VRIN” attributes: value (V), rarity (R), inimitability (I), and non-substitutability (N) (Mata, Fuerst & Barney, 1995). For competitive advantage to be potentially sustainable, the resource must also be imperfectly mobile and appropriable (Wade & Hulland, 2004). Bharadwaj (2000) argues that resources will survive imitation when protected by isolating mechanisms such as time-compression dichotomies, historical uniqueness, embeddedness, and causal ambiguity.

Firms with better IT capabilities outperform other firms on profit and cost-based performance measures (Ravichandran & Lertwongsatien, 2005). However, performance cannot be assessed in isolation from external market dynamics. Industry forces and changing market conditions affect performance (Rivard, Raymond & Verreault, 2006). Further, Wang et al. (2012) suggest that capability

building, core competencies, and resource structuring are essential for firm innovation and lead to better firm performance, especially in dynamic environments (Rivard, Raymond & Verreault, 2006).

Consider, for example, that many firms have access to the same basic resources such as hardware, software, network equipment, and HR. While on the one hand we see a number of firms excel at digital innovation by effectively managing and exploiting these resources, on the other hand we see firms that fail to do so. These firms tend to become stagnant and often fail to innovate as effectively as their rivals. For example, Company A and Company B compete within the same industry and use the SAP-provided solution for their Enterprise Resource Planning (ERP) needs. Company A allocates in-house IT capital, talent, and research dollars consistently every year, making changes and ensuring that the ERP function becomes a strategic asset for the company. In doing this, it makes structural, procedural, technical, and managerial changes to how it operates. On the other hand, Company B chooses to use ERP simply as a means of efficient planning and operations, without necessarily making the effort to dedicate resources or align its ERP and overall business strategies. Although both companies use the same basic ERP SAP resources such as the hardware, software, and networking modules, the way their operations and strategy are organized around the ERP solution differs to a great extent. We may see Company B make some gains in the short term, but in the longer term, in all likelihood, Company A would be more innovative and effective at extracting maximum value from its ERP solution.

So far, we have discussed IT innovation as a causal phenomenon with IT resources and IT capabilities affecting innovation outcomes. From a different theoretical perspective, there is a “process-based” argument seen in the IT innovation literature as well. This process-based perspective also begins with resources and capabilities. Joshi et al. (2010) support this process-based view of firm performance based on IT capabilities that enable innovation, but they stress the importance of the absorptive capacities and learning capabilities of the firm in order to sustain competitive advantage in dynamic environments. Joshi et al. (2010) call their



**Figure 1: The process view of innovation**

process-view the “innovation pathway”. By exploiting IT resources, firms may achieve moderate levels of competitive advantage in stable environments. However, in order to remain competitive in dynamic environments, firms must build IT capabilities and dynamic capabilities. Next, we examine these capabilities in more detail.

### *IT Capabilities and Dynamic Capabilities*

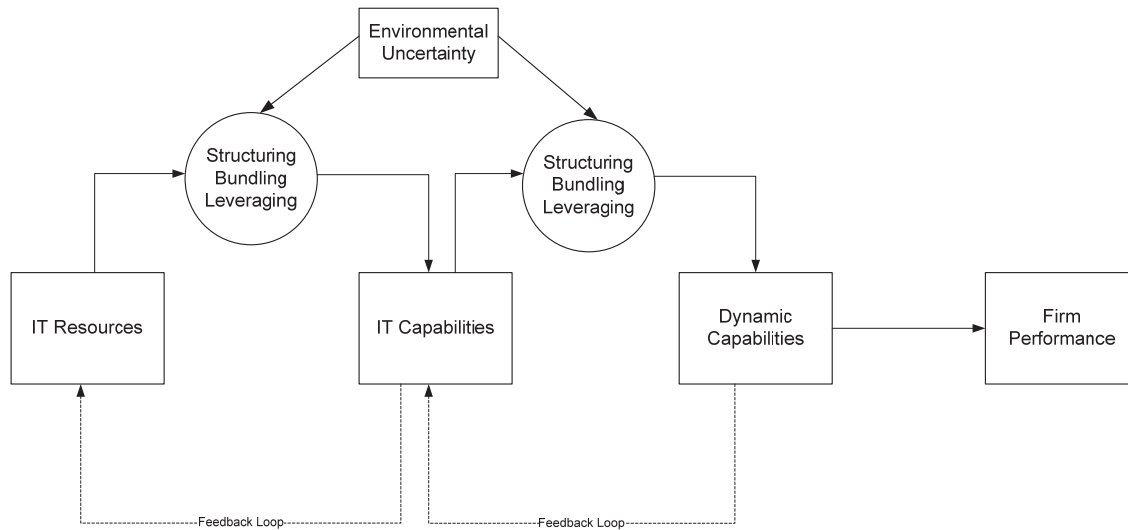
In the literature on IT innovation that examines firms operating in dynamic environments (with higher levels of environmental uncertainty), there is much discussion of IT capabilities and dynamic capabilities. Constructs such as IT-enabled agility, improvisation, and ambidexterity are discussed (Overby, Bharadwaj & Sambamurthy, 2006; Sambamurthy, Bharadwaj & Grover, 2003; Tallon & Pinsonneault, 2011). These studies also support a “process-based” view of IT-enabled innovation. For example, Kim et al. (2011) define process-oriented dynamic capabilities as “a firm’s ability to change organizational processes to achieve better integration, cost reduction and business intelligence”. Daneels (2008) states that “dynamic capability is the *competence to build new competences*”. Peppard and Ward (2004) explain how firms can convert resources, which are defined as stocks of available factors that are owned or controlled by the firm, into competencies, which can be viewed as the ability to deploy combinations of firm-specific resources to accomplish given tasks. They define capabilities as the strategic application of competencies.

Furthermore, the Peppard and Ward (2004) description of capabilities intersects with two other areas that we have previously discussed: 1) that there is a process for using IT resources to drive innovation and, more generally, firm performance and 2) that second-order capabilities also drive this performance. Unfortunately, there is little description of “how” this process of conversion takes place. Seddon (2014) states that IT resources rarely pro-

vide competitive advantage directly, but rather, it is the way that they are used (or integrated) in combination with other resources that provides such advantage. This integration of resources with other aspects of the business provides prominence to IT capabilities and dynamic capabilities (in more turbulent environments). Hence, we turn to resource orchestration theory to provide insights regarding this process of conversion of resource combinations into capabilities.

For example, in a digital world, firms increasingly leverage data regarding customers, suppliers, vendors, markets, operations, supply chains, etc. which is stored in various systems to develop business intelligence and strategic capabilities. Using “data-as-a-resource” and building business intelligence capabilities that enable making strategic and tactical decisions, fostering alliances, and improving customer service, firms are able to build competencies that were previously non-existent or inconceivable. The consultancy firm Strategy& (Nair and Narayanan, 2012) describes this trend of building capabilities using underlying data by stating that “...the world is facing a data deluge never seen before...companies are positioning themselves to compete based on their access to and use of big data... many of them start with technology, but that won’t serve you well. Instead, take a capabilities-driven approach...look first at your company’s overall strategy; then at the categories of data that will be valuable to you; then how you can put it to use; and finally at the tools, skills and practices you need.” Hence it is important to understand how digital resources and capabilities are inter-related and how firms can leverage them effectively.

Figure 1 shows the conversion process. IT-enabled innovation is fueled by resources, capabilities, and dynamic capabilities. Next, we discuss resource orchestration theory and how it can be leveraged to discuss IT-enabled innovation.



**Figure 2: Resource Orchestration View**

### *Resource Orchestration Theory (ROT)*

Resource orchestration theory (ROT) analyzes how selection and structuring of human, social/network, financial, and technological resources can be used to exploit opportunities and gain competitive advantage, achieve growth, and create value (Sirmon et al., 2011). Resource orchestration involves structuring, bundling, and leveraging of resources as three broad processes. There are several sub-processes within each process. Structuring involves acquiring, accumulating, and divesting. Bundling involves stabilizing, enriching, and pioneering. Leveraging involves mobilizing, coordinating, and deploying (Sirmon et al., 2011). ROT is newer than RBV and has demonstrated how some firms are able to orchestrate, exploit, and coordinate their resource portfolios better than others (Sirmon et al. 2007, 2011). RBV states that possession of requisite resources is a necessary but insufficient condition for creating value. ROT extends this argument to assert that firms must also about know how to accumulate, bundle, and leverage resources in order to generate sustainable returns. Sirmon et al. (2011) argue that resource orchestration is contingent upon three dimensions: the different phases of the firm's life cycle; firm breadth in terms of different strategies; and depth in terms of operational, tactical, and strategic levels. ROT relies on the "process-based" view of resource usage by the firm. Specifically, it states that because the firm must

have resources to bundle into capabilities and because capabilities must exist for leveraging to occur, the resource orchestration process is sequential to a large extent (Sirmon, Hitt & Ireland, 2007).

In line with this theoretical perspective, several studies pay attention to the resource orchestration process to reveal how a focal firm can orchestrate resources at its disposal as part of its strategy to achieve competitive advantage. For example, Cui et al. (2016) utilize the concept of resource orchestration as a theoretical lens to develop a framework of how resources are orchestrated under the guidance of an indigenous, exogenous or collaborative strategy to achieve e-commerce enabled social innovation. Cui and Pan (2015), in their study on the transformation of a traditional manufacturer to an online-to-offline firm, reveal the evolution of resource-focused actions and resource configurations.

Furthermore, ROT takes into account environmental uncertainty, which is a key consideration for firms operating in dynamic and highly competitive environments such as the IT industry. ROT also addresses gaps regarding how firms can convert resources into capabilities and capabilities into dynamic capabilities. The ROT model incorporates feedback loops allowing continuous adaptation for synchronization and fit with the environment. Recent ROT studies show the importance of learning and knowledge capabilities when altering the

resource portfolio of a firm (Lanza, Simone, and Bruno, 2016). For example, when new knowledge resources must be added to a given unit, the receiving unit should not be hindered by uncertainty with respect to the contribution of the new resources (Lanza et al., 2016). Thus, the orchestration of resources is dynamic, with change resulting from adapting to environmental contingencies and from exploiting opportunities created by those contingencies. Furthermore, ROT also explains how firms can deal with environmental shocks while managing resources effectively to sustain competitive advantage. See Figure 2.

## THEORETICAL EXPLANATIONS

### *The Role of IT Resources*

Barney (1991) classified firm capital resources as being physical, human, and organizational. Using this categorization, we categorize IT resources as follows: 1) IT infrastructure, 2) IT human resources, and 3) IT-enabled intangibles (Barney, 1991; Bharadwaj, 2000). Firms cannot depend solely on IT infrastructure or IT human resources (staff who possess appropriate skills for IT systems and applications) to drive their business. Traditional IT assets can play a strategic role only when they are combined with organizational resources to create IT-enabled intangible resources (Nevo & Wade, 2010). It is also important to remember the significance of the IT-enabled intangible resources to the firm (Bharadwaj, 2000). More contemporary research on digital innovation looks at multi-dimensional aspects of IT resources by combining all of the above sub-categories. Contemporary “digital resources” are seen as the collection of technological and human components, networks, systems, and processes that contribute to the functioning of an information system and consists of both social and technical elements (Henfridsson and Bygstad, 2013).

#### IT Infrastructure

IT infrastructure can be defined as the physical IT assets which form the core of a firm’s overall IT infrastructure comprising computer and communication technologies, and shareable technical plat-

forms and databases (Bharadwaj, 2000). More broadly, digital infrastructure is defined as “the core of general functionality upon which other applications can be built” (DiLauro, 2004). Today firms do not need to “own” their digital infrastructure. Many use cloud services (such as Amazon’s Elastic Compute Cloud or EC2, Microsoft’s Azure, and Google’s Cloud Platform) that provide highly efficient, cost-effective, and scalable IT infrastructure (Bharadwaj, et al., 2013). This reduces their IT infrastructure and capital costs.

#### IT Human Resources

IT human resources are organizational human resources that are engaged in IT activities and have IT training, experience, relationships, and insights (Bharadwaj, 2000). IT human resources have “technical skills” and “managerial skills”. Technical skills comprise programming, systems analysis and design, and competencies in emerging technologies, while managerial skills include effective IS function management, user community coordination and interaction, project management, and leadership skills. Success or failure of IT projects depends on the technical and managerial skills of IT human resources (Chesbrough, 2007; Duhan, Levy & Powell, 2001; Ravichandran & Lertwongsatien, 2005). This suggests that technical training, personnel development, and harnessing the managerial acumen of IT human resources can provide firms with competitive advantages. Using a ROT perspective, past studies show how human resources that are highly skilled in knowledge work, such as IT human resources, must be considered as a whole and not only as the sum of individual resources if the firm intends to leverage these resources for strategic purposes (Lanza et al., 2016). Furthermore, in order to maintain strategic advantage in dynamic environments, firms must consistently renew their human capital endowment at the firm level while paying attention to the experience of the newly acquired resources (Lanza et al., 2016).

#### IT-enabled Intangibles

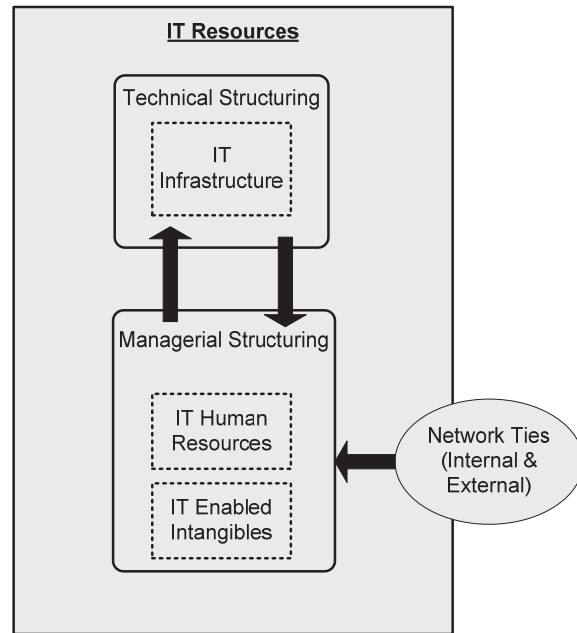
IT-enabled intangibles represent the enabling role of IT with respect to several organizational intangibles that can be grouped in three categories: knowledge assets, market orientation, and synergy

(Bharadwaj, 2000). Knowledge assets represent a firm's ability to integrate, transfer, and apply knowledge. Market orientation is the ability to track and predict changing market preferences (customers, suppliers, etc.), especially in volatile markets. Synergy is the sharing of resources and capabilities across organizational divisions.

#### Applying ROT to IT Resources

According to Sirmon, Hitt and Ireland (2007), resources need to be configured, bundled and leveraged to form firm-level competencies to gain value. Wright, Clarysse, and Mosey (2012) describe the selection and structuring of resources as an important precondition for converting them into competencies. Selection can be defined as “strategic choices made by the manager in picking the resources for the firm in a strategic manner” (Sirmon et al., 2011), while structuring can be defined as “acquiring, accumulating, and divesting” resources in a strategic manner based on the needs of the organization (Sirmon et al., 2011). Overall, the selection and structuring process requires managers to identify resources, make investments related to them, design organizational and governance structures for the firm, and create business models (Sirmon et al., 2011). For example, in a healthcare information systems organization, the “selection” of HR resources for a project where a balance of technical, managerial, and medical skills are required is extremely critical (Booker and Trabulsi, 2009). Similarly, in complex ehealth environments, three forms of knowledge workers—information systems specialists, health care specialists, and business analysts—have to make significant contributions; to ensure project success, it is important that the right socio-technical resources are organized in the right manner.

There are two aspects of selection and structuring: 1) technical aspects and 2) managerial aspects. Within the IT context, structuring (which we focus on) is often a more challenging activity than selection, as selection is generally supported by well-established processes such as Requests For Proposals (RFPs) or Requests For Quotations (RFQs). Figure 3 shows the structuring of IT resources. Wang et al. (2012) suggest that resource structuring is essential, along with capability building and core competen-



**Figure 3: IT Resource Structuring**

cies, for firm innovation. The combined selection and structuring of IT resources, which is required for competitive advantage, can be done in a number of ways.

For example, IT resources can be developed internally, they can be acquired, or they can be shared. Effective management and exploitation of these resources, and combining them with appropriate systems and processes, can lead to innovation (Wang et al., 2012). The technical aspects of structuring relates to the tools and technologies deployed by the firm. With respect to the *technical structuring* of IT resources, firms can rely on a number of traditional tools and methodologies such as enterprise architecture, IT infrastructure library, and IT project portfolio management. With respect to the *managerial structuring* of IT resources, Sirmon et al. (2011) highlight resource-based actions of managers, demonstrating how these actions influence firm outcomes such as value creation and the development of competitive advantages. Additionally, organizational learning and the notion of “fit” are identified as foundational. Thus development of IT human resource skills and IT-enabled intangibles (such as quality control, information and knowledge flow, etc.) can easily fall within the scope of managerial resource structuring (Sirmon et al.,

2011).

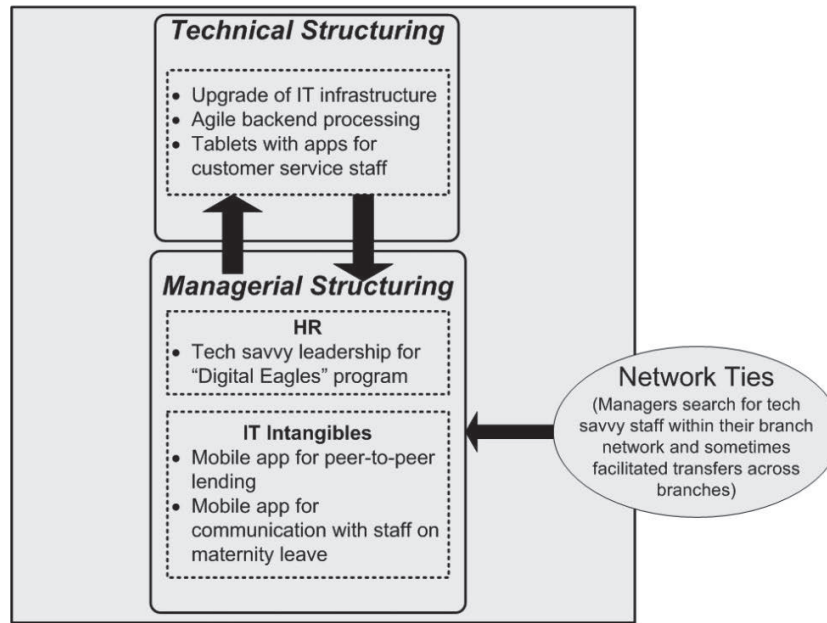
From a practitioner standpoint, resource structuring can be associated with the provisioning of IT tools and technologies that are used within the organization. Technical structuring can be related to the enterprise architecture, server configurations, technical design, etc. and managerial structuring can be related to project management issues, human resource management, and development of training programs as well as knowledge sharing across the organization. The bundling of resources is more closely related to how resource bundles are deployed in an efficient manner across the organization. From an IT perspective, the bundling process is directly reflected within the IT governance practice of an organization, where the use of one or more IT archetypes (Weill, 2004) can determine how the organization chooses to bundle its IT resources. Furthermore, bundling activities are also reflected in how resource allocation works within individual IT projects. For example, some organizations may have a central Project Management Office (PMO) with shared project resources, while others may choose to operate within functional silos with each business unit handling its own responsibility of project staffing and resource allocation. Finally, leveraging these structured and bundled resources requires in-depth knowledge regarding organizational needs and synergies. Organizations that use software tools for project portfolio management, and tend to rely on well-established industry standards for selection and allocation of resources towards their needs, tend to be more successful.

To highlight resource structuring and bundling, we use the case of Barclays bank and its digital transformation (Uddin, 2016; Wainwright, 2016). A few years ago, Barclays set itself a goal of having “the most digital savvy workforce in UK retail.” In order to achieve this goal, Barclays required extensive selection, structuring, and bundling of the resources at its disposal. First, it focused on selection of appropriate IT and human resources to lead this digital transformation. It reorganized its IT infrastructure to support wifi-enabled tablets (iPads) at all its UK branches. It had to also invest in its backend infrastructure to make it more agile and light in order to provide content quickly to these devices. Thus, it had to make a selection as to

which cloud services to use to provide the appropriate infrastructure required to support the transition. On the HR side, it also needed to select tech-savvy leaders who would lead this process and could spark the interest of other executives and staff in driving of the project forward. It did this by selecting leaders under its “digital eagles” program and entrusting them with the responsibility of leading various aspects of the project (Wainwright, 2016).

Once the technical and HR selection was made, Barclays needed to structure its organization in order to support this endeavor. It organized its workforce into teams that would become part of digital training and it also set up innovation labs and workshops. The structuring of socio-technical resources was an important step as Barclays needed to bring together technical experts who could design apps with managerial and customer service staff that had a good sense of the requirements for apps to address the issues and challenges that they faced on a daily basis. For example, Barclays introduced an app to support peer-to-peer lending and another one to digitally manage communication between the bank and those off on maternity leave. These apps provided nimble, seamless channels of communication and collaboration, ensuring higher productivity. See Figure 4 for an ROT view of resource structuring at Barclays.

Interestingly, Barclays structured and bundled its IT and human resources simultaneously. From a technical perspective, it had restructured its back-end and front-end IT infrastructure. By bundling the back-end changes with the front-end tools and providing training to its staff, it was able to support many IT initiatives requested by customer service staff and other executives. One such initiative was to develop a web-based platform where staff could share their stories about how they had been able to help customers by using the new in-branch IT hardware and software. To leverage this new resource more effectively along with the new tech-savvy workforce it had trained, Barclays has started converting redundant branches into ‘Eagle Labs’—some are digital workspaces for startups, others are maker studios equipped with 3D printers and laser cutters (Uddin, 2016). For Barclays, bundling and leveraging is best explained by “*the bind of*



**Figure 4: Resource Structuring at Barclays**

*traditional and new, the blend of offline and digital... which is a hugely important mix for the brand's marketing strategy and the business is innovating in lots of different ways" (Wainwright, 2016).*

### **The Role of IT Capabilities**

According to ROT, resources must be configured, bundled and leveraged to create firm-level competencies to enable them to gain value (Wright, Clarysse & Mosey, 2012). Once these competencies are internalized, they are very difficult for competitors to imitate. Several aspects of competency development vary depending on the IT context (Rasmussen, Mosey & Wright, 2011). However, ROT argues that, regardless of the development trajectory, the resulting competencies can be bundled into higher-order capabilities.

From a theoretical standpoint, as outlined earlier, resources that possess VRIN attributes tend to provide better opportunities for competitive advantage (Eisenhardt & Martin, 2000; Mata, Fuerst & Barney, 1995). Possessing resources without leveraging them for advantage is counterproductive for the firm. IT tools and processes can be used to exploit VRIN resources (Tippins & Sohi, 2003). Second, in an IT context, the bundling of resources takes place to develop a particular type of capability,

i.e., IT capability which can be defined as the ability to translate the business strategy into long-term information architectures, technology infrastructure and resourcing plans that enable the implementation of the strategy (Peppard & Ward, 2004). Previous research shows that IT capabilities comprise IT infrastructure flexibility, IT personnel expertise, and IT management capability (Kim et al., 2011). Using various IT systems in combination with human IT resources and other infrastructure, a firm can develop effective IT capabilities. This is closely related to the "bundling" of resources in ROT and illustrates the process shown in Figure 1.

Using Kim et al. (2011), we argue that IT infrastructure (an IT resource) supports IT infrastructure flexibility (an IT capability), IT human resources (an IT resource) supports IT personnel expertise (an IT capability), and IT-enabled intangibles (an IT resource) supports IT management capability (an IT capability). According to ROT, resources within the firm's resource portfolio are integrated (i.e., bundled) to create these capabilities, with each capability being a unique combination of resources allowing the firm to take specific actions (e.g., marketing, and R&D) that are intended to create value for customers (Sirmon, Hitt & Ireland, 2007). In the IT context, firms bundle

systems that are deeply embedded within IT processes and possess unique functionality, thereby creating IT capabilities (Pavlou & El Sawy 2006).

Pavlou and El Sawy (2010) categorize systems that provide critical IT capabilities as follows: 1) project and resource management systems which are IT tools for resource allocation, task assignment, and scheduling; 2) organizational memory systems such as knowledge coding, directories, and retrieval IT functionalities, that support the acquisition, assimilation, transformation, and exploitation of knowledge practices; 3) cooperative work systems such as conveyance, presentation, and convergence systems, that support real-time communication and group collaboration; and 4) business intelligence systems which provide functions to support organizational sense-making of, and reacting to, environmental change, e.g., monitoring and alerting functions for business events, what-if analyses, and data exploration and visualization tools (Park & El Sawy, 2012).

According to ROT, leveraging involves processes (i.e., mobilizing, coordinating, and deploying) that apply a firm's capabilities to create value for customers and wealth for its owners (Sirmon, Hitt & Ireland, 2007). In general, capabilities must be mobilized before they can be coordinated and deployed; thus, mobilizing is the first process firms use to successfully leverage their capabilities. Kim et al. (2011) suggest that human IT resources and IT infrastructure resources are drivers of IT capability and that these relationships are stronger in the presence of "management capabilities". In addition, Bhatt and Grover (2005) state that resources such as the quality of IT infrastructure and the skill level of IT employees, when combined with specific capabilities that provide value and flexibility, lead to competitive advantages. Pavlou and El Sawy (2006) suggest that firms must focus on how they can leverage IT functionalities to better reconfigure and execute business processes. They point towards leveraging IT systems and applications for strategic purposes, especially in turbulent business environments.

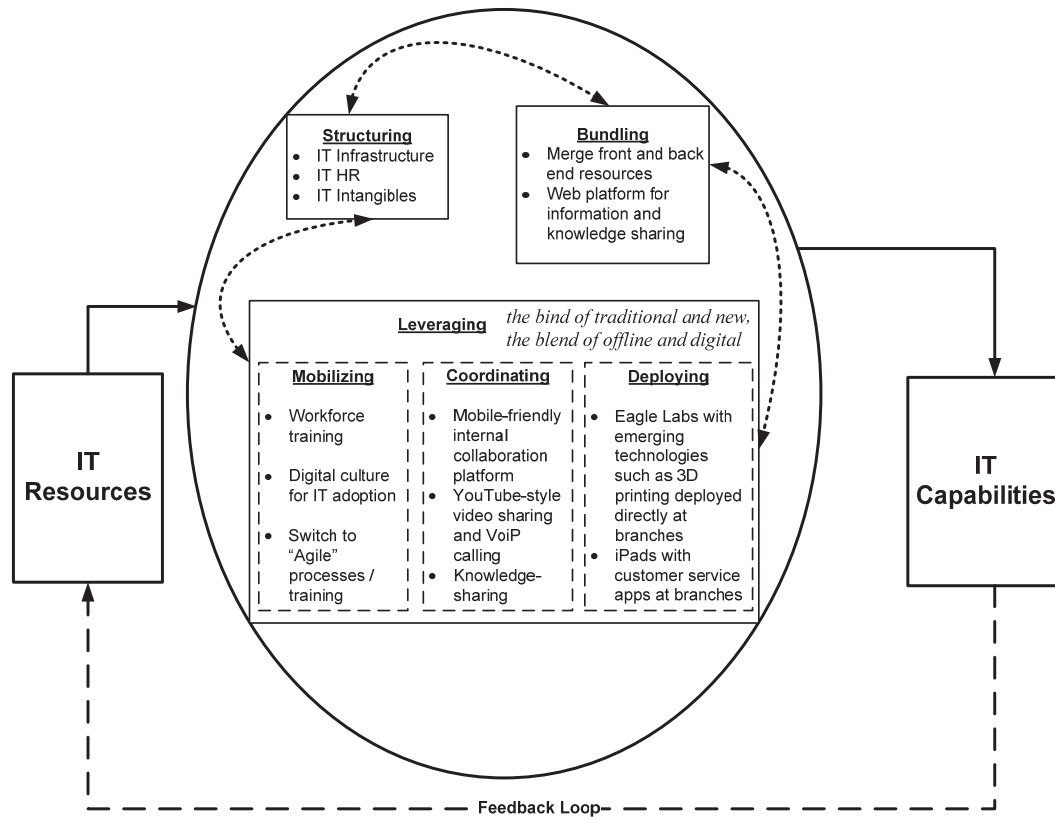
Using the Barclays example once again, we can illustrate mobilizing, coordinating, and deploying of IT resources to develop strategic capabilities that lead to innovation and improved performance.

Once the IT resources have been structured and bundled appropriately either for leading digital innovation or as a response to competitive pressures, it is important to continuously iterate and develop strategic capabilities. Barclays opted to do this by taking a mobile-first approach in its transformative initiatives. To do this, it had to *mobilize* a lot of the technical, managerial, and training resources it had at its disposal. It needed to foster a culture specifically within the organisation that responded quickly to customers and their problems. It trained its executive employees to test and try new ideas and products often—investing only in new ideas they thought were excellent for the customer. It provided them with the tools and knowledge required to conduct these experiments and make appropriate decisions. Thus it mobilized a large part of its workforce to undertake "agile" training for decision-making, customer service, and IT adoption. See Figure 5.

Additionally, Barclays set up *coordination mechanisms* to undertake this exercise in a planned manner. The creation and sharing of knowledge about specific issues was very important in order to smoothly transition to this new way of operating. Barclays rolled out a new mobile-friendly internal collaboration platform which replaced older Sharepoint sites and added new capabilities such as training apps, YouTube-style video sharing and VoIP calling (Uddin, 2016). Once these initiatives had gained enough critical mass, Barclays decided to formalize them and train most of its workforce to make them "mobile and digital savvy" in ways that would help them improve the performance of their jobs. Since then, Barclays has *deployed* iPads in every branch and has processed two billion pounds of unsecured lending, 50 percent of which was done on a mobile phone. In less than three years its mobile app has attracted 5.2 million customers with approximately 1.7 million of them logging on daily (Wainwright, 2016). Thus, by leveraging the right IT resources, Barclays was able to create a digital capability for mobile banking. See Figure 5.

### *The Role of Dynamic Capabilities*

Firms that possess IT leveraging capabilities tend to typically perform well in stable market conditions.



**Figure 5: ROT in Practice at Barclays**

However, due to several external factors such as competitor actions, diminishing resource costs, etc. the market environment may not remain stable. In turbulent environments, the firm must develop second-order capabilities to dynamically adjust its IT strategy and resource usage, such that it can sustain its competitive advantage. Thus, it needs to develop new IT dynamic capabilities (Lu & Ramamurthy, 2011; Overby, Bharadwaj & Sambamurthy, 2006; Sambamurthy, Bharadwaj & Grover, 2003). A dynamic capability can be defined as the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments, (Teece, 1998; Teece, 2007; Teece et al., 1997). For the purposes of this article, we illustrate dynamic capabilities using IT-enabled agility (El Sawy et al., 2010). Agility has been defined as “the capacity for moving quickly, flexibly and decisively in anticipating, initiating and taking advantage of opportunities and avoiding any negative consequences of change” (McCann, Selsky

& Lee, 2009). Tallon and Pinsonneault (2011) define organizational agility as the ability to detect and respond to opportunities and threats with ease, speed, and dexterity. Organizational agility involves IT-enabled agility (Overby, Bharadwaj & Sambamurthy, 2006; Sambamurthy, Bharadwaj & Grover, 2003). Lu and Ramamurthy (2011) show how IT capability can complement other organizational resources to enhance agility.

We use ROT to make the same arguments for IT capabilities as those for IT resources. IT capabilities must be structured, bundled and leveraged in order to provide flexibility and value to the firm in dynamic environments. It is important to note that structuring, bundling, and leveraging of capabilities can occur at the operational, tactical, and strategic levels in the firm.

First, we address the bundling aspect of ROT for IT capabilities. The bundling of one or more capabilities can provide dynamism to the firm. For example, marketing and customer service capabili-

ties can be combined in one “Customer Relationship Management” software platform. Such bundling offers integrative power of dynamic capabilities where changes can be made to the IT system in a short time to reflect changing market dynamics. Thus, integration is one way of bundling. However, it must be noted that for integration of IT capabilities, the underlying data and systems are the same systems that were “orchestrated” as part of the IT resource bundling. Thus, we call these capabilities “IT-enabled capabilities”. Furthermore, internal and external capabilities can be combined to offer bundled services as partnerships between the firm and its suppliers, partners, and even competitors. For example, Netflix has partnered with a number of external service providers to offer their digital video content on its own platform. This fact has also been highlighted in the literature on net-enabled business innovation cycles (Zahra & George, 2002) and value co-creation. Thus, capabilities bundling can result in value for customers and flexibility in providing value-added products and services. Another benefit of bundling capabilities is that it adds more options to the resource and capability portfolio of the firm. Once IT capabilities are bundled and result in new dynamic capabilities, the firm can “orchestrate” new options, thereby creating barriers to competition and imitation.

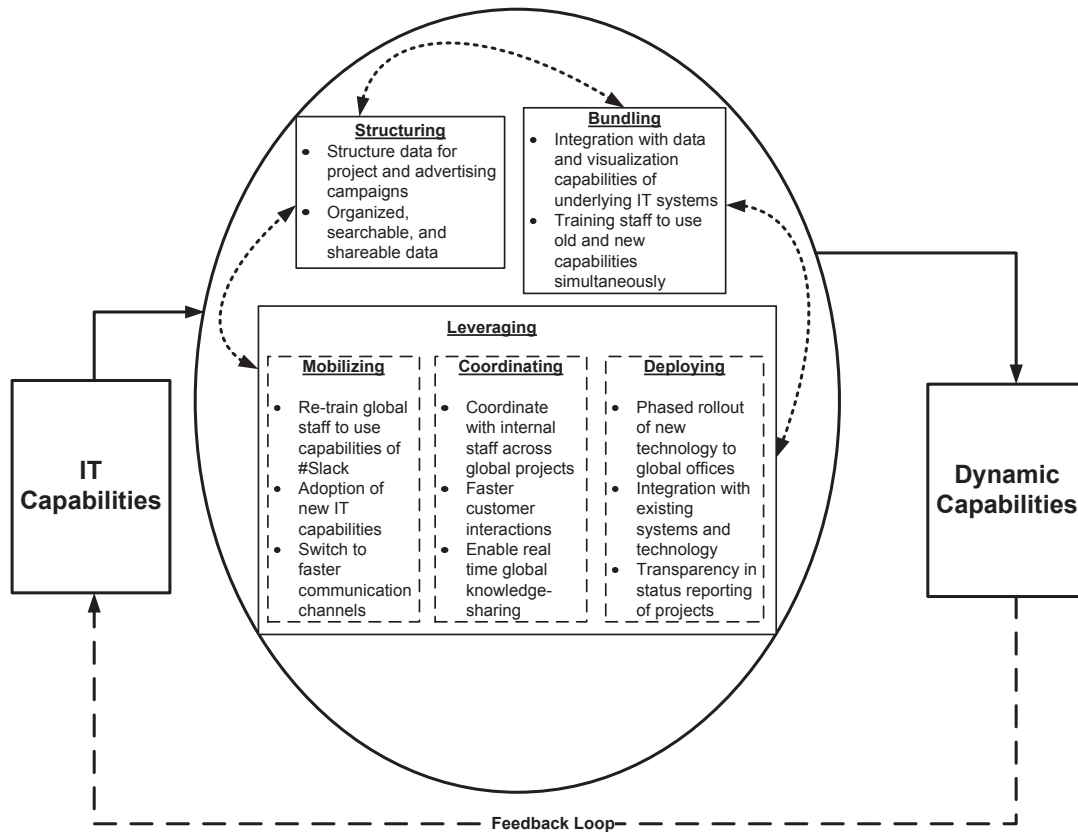
Second, we illustrate how dynamic capabilities are structured and leveraged by the firm to create competitive advantages. A recent focus of the dynamic capabilities literature has been IT-enabled knowledge and learning capabilities. As noted earlier, organizational memory systems support IT capabilities. They provide organization-wide storage, retrieval, and sharing of knowledge, which is a critical resource in highly competitive environments. For example, developing shared meaning, and sharing information accurately and rapidly across an organization’s various sub-units, can reduce redundancy and provide higher quality outcomes. Dynamic capabilities can ‘orchestrate’ underlying IT capabilities and resources as needed to enable information and knowledge to flow seamlessly across the organization.

To illustrate how dynamic capabilities can be created by the structuring, bundling, and leveraging of existing capabilities, we use the example of

“#Slack” and examine how it is used by a digital marketing agency. “#Slack” is an enterprise instant messaging, communication, and collaboration system with innovative “team communication” capabilities and groundbreaking functionality. Slack’s channels help you focus by enabling you to separate messages, discussions and notifications by purpose, department or topic, and they provide sharing, search, and notification functions. DigCom<sup>2)</sup> is a digital marketing agency with 1,700 employees in 15 offices around the world. Slack has become the central tool for communication across its departments, disciplines, and offices. Slack provides a coordination, communication, and knowledge sharing medium for various global offices and project teams as well as for the customer service unit and other business units.

DigCom was facing an issue with decision-making based on real-time information and realized that it was taking far too long to analyze, coordinate, and respond to changing situations on various projects across the globe. It had the capability to make good decisions by analyzing the underlying data and getting the right stakeholders on board, but the process was taking too long and the market realities were dynamic and were evolving faster than DigCom could react and respond. As a result, it made a decision to build a new dynamic response capability using Slack as a tool to manage and coordinate the knowledge sharing in real-time, which was needed to make these decisions.

DigCom had good IT systems and applications at its heart. As a new age digital marketing company it was using social media, cloud, and mobility effectively to gather, curate, and store data about its global projects and operations. However, when clients demanded changes within projects or its rivals came up with a competing digital campaign, it took too long for DigCom to respond by extracting the data from its underlying systems and then analyzing and responding to the situation. It took even longer to bring together an execution team that would implement the changes, coordinate with customers, and finally launch the updated campaign publicly. Then Digicom realized that it needs to invest in building a dynamic capability that would enable realtime response, coordination, and communication as well as build easily accessible



**Figure 6: Building Dynamic Capabilities at DigCom**

knowledge about its various projects that were ongoing globally. It envisioned that by clicking a button and “joining a channel” teams and individuals could quickly assess everything related to a digital media campaign and could look up customer requests, personnel, recent changes, etc. that were attached to that particular project.

DigCom decided to adopt Slack. Slack allowed DigCom to *structure* most of its global project and advertising campaign-related data in a more organized, searchable, and shareable manner. DigCom decided to *bundle* Slack with its underlying systems and capabilities so that the data regarding customers and projects was easily accessible and could be visualized in a number of ways. DigCom also *leveraged* its capabilities of working hands-on with clients at remote locations by using Slack to digitally share, edit, sync, and update global project files based on customer service requests. Overall, Slack provided a knowledge repository that had real-time, easily accessible, and important data regard-

ing various ongoing global projects. It could use this knowledge in real time to make immediate decisions in a consensus-based, transparent manner and could also harvest past data to make decisions regarding future projects and campaigns. Thus, DigCom could take advantage of its existing capabilities by structuring, bundling, and leveraging them with the help of a technology application, and created a new dynamic capability that would help it gain a competitive advantage. See Figure 6.

As a result, DigCom is experiencing quicker decision making, more efficient internal operations, shorter team meetings, and generally more transparency regarding its global projects, thereby allowing it to respond quickly to changes and market realities.

### *The Role of Environmental Uncertainty*

Environmental uncertainty can be defined as a general condition of uncertainty or unpredictability because of changes in consumer preferences and

technology developments (Pavlou & El Sawy, 2006). Market uncertainty represents ambiguity about the type and extent of customer needs. Technological turbulence involves the rapid evolution of technology, such that newer technologies may be introduced into the market rendering older technologies obsolete. Teece (2007) argues that dynamic capabilities are ‘the foundation of enterprise-level competitive advantage in regimes of rapid (technological) change’ (2007, p. 1341). Further, he disaggregates dynamic capabilities into component capabilities that are ‘necessary to sustain superior enterprise performance’ in a highly dynamic environment (2007, p. 1319). In our model (Figure 2), we portray this “dynamic environment” as environmental uncertainty. Previous studies in the extant literature show that firms that develop dynamic capabilities when encountering environments with moderate to high levels of uncertainty or turbulence, tend to outperform peers that operate in environments with low turbulence (Chae et al., 2014; Pavlou and El Sawy, 2006). According to ROT, an information deficit affects the way firms must manage resources to create value. For example, uncertainty in the industry or in potential competitors’ actions affects the type and amount of resources needed in the resource portfolio, the capabilities necessary to outperform rivals, and the leveraging strategies required to gain and maintain a competitive advantage (Sirmon, Hitt & Ireland, 2007).

Based on past literature, we argue that environmental uncertainty will moderate the effect of structuring, bundling, and leveraging. However, we recognize that a more longitudinal approach may be required to fully understand and explicate how uncertainty affects each of these processes within the ROT framework. Nonetheless, our assertion is based on past studies on IT capabilities and dynamic capabilities and we propose that similar effects will be seen within the ROT framework. We are cautious about proposing the strength or directionality of the moderating effect of environmental uncertainty on the process of conversion of resources into capabilities and capabilities into dynamic capabilities (see Proposition 3).

### Conclusion

In summary, we have explored IT resources, IT ca-

pabilities and IT-enabled dynamic capabilities using the lens of resource orchestration theory. We have broken down the process of orchestration into bundling, structuring, and leveraging and showed how IT resources, IT capabilities, and IT dynamic capabilities are orchestrated using these processes. We have also graphically displayed the three processes to assist in understanding of the orchestration process. (See Figures 1 and 2.) We have highlighted the role of environmental uncertainty. We have built theoretically on the nomological network of constructs described in previous studies as the “innovation pathway.” Our propositions, summarized below, can be tested empirically in future research:

- *Proposition 1: The structuring, bundling and leveraging of IT resources are positively related to the formation of IT capabilities.*
- *Proposition 2: The structuring, bundling and leveraging of IT capabilities are positively related to the formation of IT dynamic capabilities.*
- *Proposition 3: Environmental uncertainty moderates the structuring, bundling, and leveraging of IT resources and capabilities.*
- *Proposition 4: The formation of IT dynamic capabilities is positively related to firm performance.*

We have practically illustrated these propositions using contemporary firms such as Strategy&, Barclays, and DigCom.

### CONTRIBUTIONS

First, this article provides new insights into the process of resource orchestration in an IT/IS setting. Second, this article extends the literature on RBV and ROT by combining them with the IT-enabled innovation literature. Third, it opens up the “black box” of the relationships among IT resources, IT capabilities and IT-enabled dynamic capabilities by using ROT to explain how the processes of structuring, bundling, and leveraging result in the conversion of resources to capabilities and dynamic capabilities. This is an important contribution because the extant literature does not provide details regarding “how” these constructs interrelate and resource conversions take place, to

increase innovation. The article opens up new areas for the application of ROT and provides a theoretical basis to conduct further research. Thus, we have responded to calls for research into an important and evolving literature area for both strategic management and information systems disciplines. We have gone a step further than the calls for research into 1) VRIN attributes of emerging technologies and 2) showing the impact of RBV in IT contexts (Seddon, 2014). We have delved deeper into the process-based origins of RBV and ROT to show how conversion of resources into capabilities, and capabilities into dynamic capabilities leads to performance and competitive advantage. Using the theoretical lens of ROT and examples from practice, we have examined several precise elements of the theory and attempted to highlight their specific functions in practice. This has resulted in richer insights for future theoretical and practical advancements.

From a practitioner perspective, this article provides insights to firms regarding their choice, deployment, and use of IT resources for innovation. As firms struggle with lean resources and aim to maintain high operational efficiency, insight into how they can orchestrate resources to their advantage can prove useful. Similarly, firms can see more clearly how to build and orchestrate IT capabilities and dynamic capabilities, internally and externally, in order to innovate and remain competitive.

## NOTES

- 1) A very early version of this article was presented at the 4th International Conference on Innovation and Entrepreneurship, Toronto, Canada, April 2016.
- 2) We use a pseudonym to protect the identity of the organization.
- 3) The authors gratefully acknowledge the suggestions provided by the editor and an anonymous reviewer for this journal.

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