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IT-Enabled R&D for Business Value in a Global Framework

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Abstract Historically, innovation research and development (R&D) has been investigated in terms of product and, more recently, service applications. The central argument of this paper is that information technology can support R&D in the important but relatively underdeveloped area of business process development. The methodology used in this study is design science research (DSR). The approach of the work is to outline the case of the Innovation Value Institute (IVI) which was co-founded in 2006 by University of Maynooth, Ireland and Intel with the objective of transforming information technology (IT) management. Through the application of IT to the R&D process, the institute has developed the information technology capability maturity framework (IT-CMF) for managing IT for business value. Consequently, the framework is a unique example of IT-enabled R&D, developed in the context of academic-practitioner cooperation, which has a global reach. The IVI case demonstrates that innovation in IT business processes is increasingly important as a source of competitive advantage and, in doing so, it addresses key limitations in current research.

Keywords Innovation · Business process · Research and development (R&D) · Competitive advantage

Introduction

Historically, the process of product design has been well road mapped (Pugh 1991; Cross 2000) as is the case with product development methodologies (Ulrich and Eppinger 2004; Otto and Wood 2001; Cooper 1994). However, the practice of

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innovation is also taking place within radical redesign of business processes (Hammer and Champey 1994) and the change from *task*-based organizations to *process-centred* organizations (Hammer 1996). The increasingly important role of academia in supporting innovation in knowledge-based societies has led to the development of a number of models from the National System of Innovation (NIS) (Lundvall 1995) to the more recent Triple Helix model of university-industry-government relations (Etzkowitz and Leydesdorff 2000). In a more recent paper, Leydesdorff (2012) argues that the "Triple Helix indicator can be extended algorithmically, for example, with local global as a fourth dimension or, more generally, to an N-tuple of helices" (p. 25). The Innovation Value Institute (IVI 2013) has developed a framework for managing information technology (IT) for business value, the information technology capability maturity framework (IT-CMF), and it is being tested and diffused in an international context. The IT-CMF is a unique example of IT-enabled research and development (R&D), developed in the context of academic-industry cooperation, which has a global reach. The IVI was co-founded in 2006 by Maynooth University in Ireland and Intel with the objective of transforming IT management. IVI now has over 75 members drawn from global organizations such as BP, Chevron, Cisco, Fujitsu, SAP, Chevron and Ernst & Young. The IVI case demonstrates that innovation in IT business processes is increasingly important as a source of competitive advantage. This paper proposes to make a contribution by providing evidence that information technology can support R&D in the important but relatively underdeveloped area of business process development. Furthermore, a recent publication has concluded that key limitations of current research include "the ambiguity and fuzziness of IS business value" and "the unexplained process of internal and competitive value" (Schryen 2013) both of which are addressed in this paper.

Having set the scene, the paper now proceeds as follows. Firstly, a literature review is provided to support the argument that R&D is required in the area of IT business value. Then, the concept of IT-enabled R&D is explored. Following this, an overview is presented by the IVI, the international organization that has developed an IT-enabled R&D process. Finally, contributions and conclusions are outlined.

Literature Review

This section initially views IT business value in terms of supporting sustainable competitive advantage in the context of the digitalization of organizations. It then draws on work of Zaltman et al. (1973) who posited that the study of innovation involves dealing with an inherent dilemma. Following this, the paper explores what is meant by IT-enabled R&D and innovation with reference to relevant literature. The overarching argument is that information technology can support R&D in the area of business process development.

IT as a Source of Competitive Advantage

According to Feeny and Ives (1997), there was a stream of literature in the second half of the 1980s arguing that information technology was an emerging source of competitive advantage. Drawing on antecedent work such as Clemons (1986), Chamberlin

(1933) and MacMillan (1983), they proposed a conceptual framework consisting of three pillars:

- Project life cycle analysis to understand *generic lead time*
- Competitor analysis using the idea of *competitive asymmetry*
- Supply system analysis based on the notion of *pre-emption potential*

Feeny and Ives argued that their framework allows management "to consider the probability that an application, if successful, will provide advantage for long enough to properly repay the investment required" (p. 60). However, Carr (2003), in a widely debated article, claimed that because IT is now so widely available, it is no longer strategically relevant. More recently, Barney and Clark (2007) have used resource-based theory to examine IT as a source of competitive advantage and, in particular, extracted five attributes of IT based on their analysis of the literature. Of these five attributes: customer switching costs, access to capital, proprietary technology, technical skills and managerial skills, they concluded that only IT management skills are likely to be a source of competitive advantage.

Here, we quote these authors directly as it supports the thesis of our paper.

> For researchers, resource-based theory suggests that the search for IT-based sources of sustained competitive advantage must focus less on IT, per se, and more on the process of organizing and managing IT within a firm (p. 156).

According to Curley (2004), IT's contribution to business value is increasingly under the managerial spotlight and uses the term IT business value "to mean the business value contributions driven by IT investments" (p. 2). In his schema, IT investments are viewed and managed "as projects that are expected to deliver overall business benefits" (p. 9). Curly concludes that with the evolving nature of the IT discipline, "investment decision making is ripe for the introduction of a maturity framework". Such a framework would describe "the key practices that an IT organization and a firm needs to have in place to fine tune processes for delivering increased business value" (p. 59). Figure 1 shows a diagram of Curley's schema. The key practices at each level range from level 1 "where there is no defined or repeatable processes for IT business value management" (p. 60) to level 5 where "organizations begin systematically using investment performance analysis to design, measure and manage investments for optimal business value" (p. 61). The framework will be discussed further in the case study section of the paper below.

Fig. 1 Managing IT business value CMF from Curley (2004)

Now, we will examine the evolving business landscape largely driven by advances in IT and where there is a growing challenge to manage IT investments for greater business value.

IT Business Value in the Digital Firm

The spectacular growth of the internet, ubiquity of networking, globalization of business and evolution of information economies has resulted in novel business processes and new ways of sharing knowledge. These transformations are resulting in the development of the fully digital firm (Laudon and Laudon 2002). Other ICTs include mobile computing, teleworking, Web 2.0, social networking and open source that affect not only business but also society. ICT has resulted in process innovations in the firm affecting logistics, manufacturing, sales and order management, finance, human resource management as well as the support activities of design, engineering and marketing (O'Brien and Marakas 2009; Post and Anderson 2003). According to Robson (1997), "quality, innovation and service are now more important than cost, growth and control" (p. 273). She also goes on to propose a number of forces for openness: new technology, new geo-political order and new enterprises. Furthermore, Robson provides the following taxonomy of the evolution of the firm:

- *Efficiency* was the price of staying in business in the 1960s
- *Effectiveness* was the price of staying in business in the 1970s
- *Competitiveness* was the price of staying in business in the 1980s
- *Adaptability* was the price of staying in business in the 1990s

We argue that *innovation* is the price of staying in business in the 2000s and beyond, such that, sustaining innovation requires an R&D 'engine'. As Pfaffenberger (2002) puts it, "The internet has emerged as an un-paralleled public medium for communication and commerce-and it's changing our world". From an IT business process perspective, another paradigmatic shift has been the growth and diffusion of self-service technology (SST). An increasing number of business and government transactions are now being completed without human assistance. Consequently, an argument exists that self-service technology and business extends the traditional boundaries of the customer service function and has significant implications for business processes (Costello and Donnellan 2007).

A particular challenge facing IT managers is how to evaluate the value of IT investments. Bannister's (2005) review of approaches to IT evaluation identifies three strands in the literature:

- *Studies that focus on the long-term historical economic impact of investments in IS*: Examples include Brynjolfsson and Saunders (2009) who explored the so-called productivity paradox and the cumulative effect of investments in IT on organizations and Strassmann (1985) who has argued that such effects are only really assessable over long periods, maybe as long as half a century.
- *Studies of whether specific investments made over shorter periods have yielded value*: These vary from the application of innovative methods to measure value realized to use well-established methodologies, such as return on investment,

comparison of how different metrics report or combinations of measures such as the balanced scorecard (Kaplan and Norton 1992) or the Prudential Appraisal Method (Coleman and Jamieson 1994).

- *Studies assessing whether or not a potential investment in IT is worthwhile*: The time horizon here is typically fairly short, usually 5 to 10 years, though, from time to time, studies will contemplate a more distant time horizon. Almost all such studies are at the level of the organization, be it a firm or a public sector body.

Now, we will first look at the challenges faced in managing innovation and follow this by addressing the role of IT in innovation.

Managing Innovation: the Innovation Dilemma

The *innovation dilemma* highlights the tension between the two main phases of innovation: initiation and implementation and is an important concept to consider when dealing with the subject of innovation. According to Zaltman et al. (1973), the most important contribution by James Wilson (1966) as part of his theoretical work on innovation in the 1960s was the identification of the innovation dilemma which organizations face during the process of innovation. Wilson had concluded that it is easier to initiate than implement innovations by stating that it is "easier to increase the organizations capacity to generate new proposals than it is to increase its capacity to ratify any given proposal" (Wilson 1966, cited in Zaltman et al. 1973, p. 178). Wilson had taken into account the characteristic of *complexity* but, however, did not consider *formalization* and *centralization*.

The second-generation innovation dilemma proposed by Zaltman et al. 1973 is conceptualized in this paper by means of the figure below. The initiation stage is characterized by higher complexity with lower formalization and centralization. However, the implementation stage is characterized by lower complexity and higher formalization and centralization. Hence, the challenge for an organization to balance these opposing forces where mediating factors include interpersonal relations and the ability of the organization to deal with conflict.

The innovation dilemma has been presented as it is relevant to the development of innovation business processes in that it highlights the tension between the initiation and implementation stages (Fig. 2).

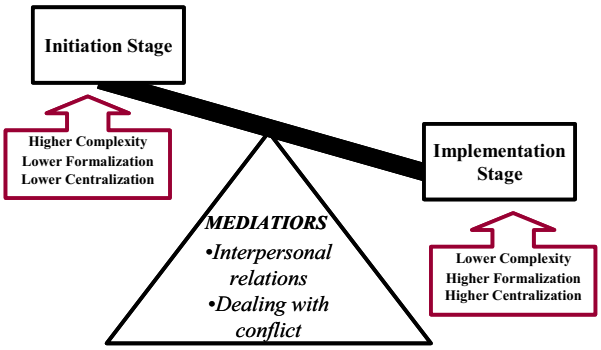

Fig. 2 Conceptualization of the Zaltman et al innovation dilemma

IT Enabling Innovation and R&D

Swanson and Ramiller (2004) start by defining IT innovation as the process by which "IT comes to be applied in novel ways" (p. 556) and conclude that the literature on bandwagon phenomena indicates that much supposedly innovative behaviour is actually "me too" activities (p. 544). This leads them to propose the application of the concepts of mindfulness and mindlessness to IT innovation theory. Their call for an enlarging of the IS academic research to "investigate the cognitive processes of organizations" (p. 577) and to engage with the psychological as well as the organizational literature has relevance for the present study. Fichman (2004) takes the concept of mindfulness with six others (innovation configurations, social contagion, management fashion, technological destiny, quality of innovation and performance impacts) and presents them as emerging perspectives that can take IT innovation research beyond its present dominant paradigm which he believes is showing signs of exhaustion. He defines the dominant paradigm, derived from economic-rationalistic models, as positing that an organization with the greater quantity of right stuff will demonstrate a greater quantity of innovation. Recently, a comprehensive analysis of an extensive body of research, based on Fichman's description of the dominant paradigm resulted in a revised depiction of the model that differentiated between individual and organizational characteristics and prescribed the best predictors of IT adoption for each characteristic (Jeyaraj et al. 2006). This study concluded with a counter argument that the dominant IT paradigm was alive and well and continues to make significant progress.

Other scholars, albeit a minority, have taken a different approach when viewing innovation and information technology. In this case, they have explored the role, both positively and negatively, of IT in innovation which is the main concern of this paper. For example, the work of Tarafdar and Gordon (2005) examines how a firm's IT capabilities affect its ability to innovate. They explain that the IT capability of the firm has five dimensions: IT infrastructure, IT human resources, IT-related intangible resources, IT coordination and IT governance. Donnellan's (2004) empirical study described how companies such as Analog Devices Inc. (ADI) are using IT systems to support and promote innovation. On a more general level, Pavitt (2005) argues that ICT can support innovation by reducing search and selection costs and digitalization, in general, has resulted in systems of increasing complexity. Elsewhere, Whelan (2007) examines the relationship between the structural properties of electronic networks of practice and the successful diffusion of innovative knowledge. Dodgson et al. (2005) propose that a range of new technologies such as simulation and modelling tools, virtual reality, data mining and rapid prototyping have led to the intensification of innovation. They have used an umbrella term—innovation technology (IvT)—to describe these new tools and methods. IvT, they argue, is being increasingly applied to innovation and indeed is dramatically changing the nature of the innovation process. Furthermore, they contend that IvT is having a significant influence on accomplishing creative tasks and on defining the ways in which knowledge is constructed, shared and used. They describe their schema of the application of IvT to the innovation process in terms of three characteristics: *thinking*, *playing* and *doing*.

- *Think*: In that, IvT can liberate creative people from mundane tasks and enable them to experiment more freely and widely, resulting in the production of a variety of options.

- *Play*: Design, prototyping and testing can be carried out more effectively and economically. Also, investment choices can be delayed until market and technology patterns become clearer.
- *Do*: The increasing *digital* integration with other types of technology provides innovators with greater confidence in their ability to transform ideas into products and services.

Furthermore, they argue that the IvT enablement of thinking, playing and doing is a major support to organizations in dealing with *disruptive innovation* (doing things differently) and *incremental innovation* (doing existing things better).

Research Approach: Design Science Research

This section will provide an overview of the research approach employed as a lens in this study. The seminal paper by Hevner et al. (2004) provides "a concise conceptual framework and clear guidelines for understanding, executing and evaluating (design science) research (DSR)" (p. 75). They go on to state that design science is fundamentally a problem-solving paradigm that seeks to "create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, implementation, management and use of information systems can be effectively and efficiently accomplished" (p. 76). Furthermore, they trace the roots of design science to Simon's well-regarded publication of *The Sciences of the Artificial* (Simon 1996). In an earlier work, Markus et al. (2002) outline their use of design science to address the challenge of developing executive information systems (EICs). An important concept in design science is that of an IT artefact which is summarized in Table 1 below.

Hevner et al. describe that the primary goal of their paper is "to inform the community of IS researchers and practitioners of how to conduct, evaluate, and present design science research" (p. 77). According to Walls et al. (1992), design is both a process (or set of activities) and a product (artefact), while Markus et al. (2002) explain that a build-and-evaluate loop is usually iterated a number of times in the development of an artefact. Table 2 summarizes seven guidelines proposed by Hevner et al. In addition, March and Vogus (2010) argue that design is fundamental to the management disciplines as managers "are engaged in the design and implementation of business systems aimed at improving organizational performance" (p. 196). Our work builds on this point by applying a design science approach to the development of a business process framework.

Recent research on the implementation of design science research (DSR) has found that while the guidelines of Hevner et al. are largely endorsed, caution needs to be exercised when applying them (Venable 2010).

Table 1 A taxonomy of IT artefacts from Hevner et al. (2004, p. 77)

Artefact	Description
Constructs	Vocabulary and symbols
Models	Abstractions and representations
Methods	Algorithms and practices
Instantiations	Implemented and prototype systems

Table 2 Design science research guidelines from Hevner et al. (2004, p. 83)

Guideline		Description
Guideline 1	Design as an artefact	Design science research must produce a viable artefact in the form of a construct, a model, a method or an instantiation
Guideline 2	Problem relevance	The objective of design science research is to develop technology-based solutions to important and relevant business problems
Guideline 3	Design evaluation	The utility, quality and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods
Guideline 4	Research contributions	Effective design science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations and/or design methodologies
Guideline 5	Research rigor	Design science research relies upon the application of rigorous methods in both construction and evaluation of the design artefact
Guideline 6	Design as a search process	The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment
Guideline 7	Communication of research	Design science research must be presented effectively both to technology-oriented as well as management-oriented audiences

Now, we will present an international institute that is undertaking business process R&D to address the challenges outlined in this review section. Furthermore, the enterprise has developed its business process framework using the DSR approach.

A Case Study of R&D in an International Context

R&D is being undertaken by the IVI (2013), and we will provide an overview of its organization and methodology in this section. During the design process, researchers participate together with practitioners within research teams to capture the views of key domain experts. The innovation capability maturity framework extends directly the approach proposed by the IT-CMF introduced and described in a number of publications (Curley 2004, 2007). Also, the research approach is significantly influenced by the emerging research area of engaged scholarship (Mathiassen and Nielsen 2008; Van de Ven 2007).

A novel approach to IT innovation effectiveness realization has been proposed by Peppard et al. (2007). The *IS benefits management* approach advocated by the authors is defined as "the process of organizing and managing so that the potential benefits from using IT are actually realized" where *benefits management* emphasizes that benefits arise only from changes made by individual users or groups of users, and these changes must be identified and managed successfully. *Benefits realization* and *change management* are therefore inextricably linked. This is the case when the project is explicitly an IS-enabled or *techno-change* program. A noteworthy aspect of the benefits management approach is the application of a benefits dependency network (BDN). The BDN provides the framework for explicitly linking the overall investment objectives and required benefits with the business changes necessary to deliver these benefits and the essential IT capabilities that enable these changes. This approach is an

example of a general trend towards a *capability*-oriented view of IT as opposed to the *resourced*-based view.

The IT Capability Maturity Framework

The Innovation Value Institute has developed a framework for managing IT for business value—the IT-CMF—and this framework is being tested with leading organizations around the world. IVI's approach leverages existing frameworks and complements them with a comprehensive value-based model for organizing, evaluating, planning and managing IT capabilities. The IT-CMF proposes a high-level process capability maturity framework for managing the IT function within an organization. The framework identifies a number of critical IT processes and describes an approach to designing maturity frameworks for each process. By comparison, other IT process frameworks including COBIT, ITIL and CMMI do not explicitly provide a mechanism to address the topic of IT innovation. A sub-group of Innovation Value Institute has been concerned with building and testing the CMF for the IT innovation critical capabilities.

The IT-CMF accepts that innovations arising from both linear sequential processes and complex social processes co-exist within the same firm. The framework unifies a single approach to address the manageability of both classifications of IT innovation. For linear sequential processes, the innovation capability describes the ability or capacity to execute in a manner that increases the probability of a positive outcome in an IT innovation. For complex social processes and non-sequential activities, the innovation capability describes the pre-conditions required to increase the probability of innovation outcomes.

The IT innovation capability maturity framework describes the IT innovation capability through a five-level capability maturity framework as shown in Fig. 3. The maturity approach has been used successfully in the IT industry to describe specific stages of progression to an optimal mode of operation.

The general approach of the IT-CMF is shown in Fig. 4 through four macro processes for each of the five maturity stages. These consist of managing the IT budget, managing the IT capability, managing IT for business value and managing IT like a business. In total, 36 individual processes are managed by the framework. Potential

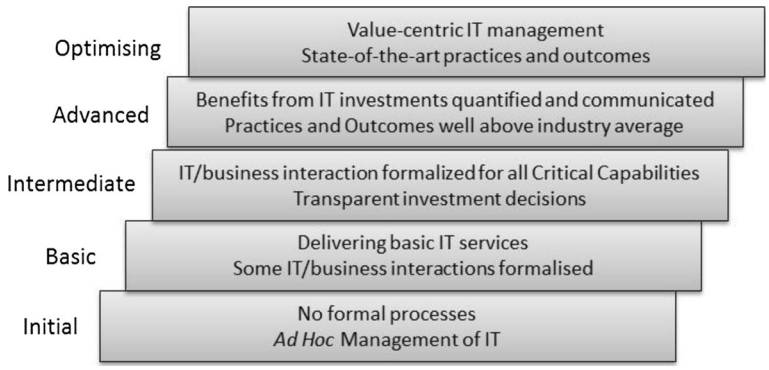

Fig. 3 IT-CMF showing the maturity levels

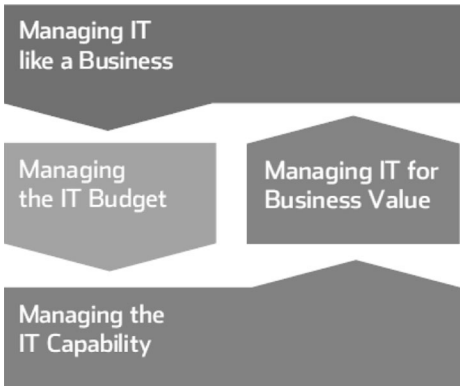

Fig. 4 IT-CMF macro processes

advantages of the capability maturity approach include its ability to present a structured, sequential stepwise function. Due to the simplicity of the model, maturity frameworks have seen wide adoption in the IT industry by large organizations (e.g. CMM) and have strong uptake amongst the community of practitioners. The approach is useful in describing a manageable approach to improvement and therefore preserves the simplicity and direct-acting approaches presented by the linear sequential process innovation frameworks. Each level of the capability maturity framework also describes a set of contextual descriptions and therefore preserves the approach presented by the non-linear school of frameworks.

Potential disadvantages of maturity model-based approaches include a tendency to adopt a somewhat instrumental, doctrinaire and mechanical approach to problems that may be quite complex. The IT innovation CMF addresses this shortcoming in two ways. Firstly, the maturity framework is augmented with additional dimensions for each of the five levels. The maturity approach chosen introduces a set of innovation capabilities at each level. Each capability is assigned characteristics, attributes and descriptions of representative outcomes on an organization. Secondly, the IT innovation CMF is augmented by linking the maturity levels to a supplementary overarching IT-CMF. Therefore, the IT innovation CMF is divided into four strategies, mirroring directly the strategies of the IT-CMF. Strategies describe the four primary activities associated with managing innovation, funding innovation activities, executing the innovation capability and assessing the value of innovations.

Broadly defined, the innovation capability is a set of actions undertaken to prepare an organization to be more innovative. This is achieved by increasing the organization's ability to enact defined innovation processes and by increasing the effectiveness and relevance of non-linear activities on innovative outcomes. Preparation in the linear sequential sense involves the creation of tools and artefacts within the firm. Artefacts may be tangible, such as systems, devices and templates, or intangible, such as activities, roles, processes and methodologies. Preparation in the complex social sense involves affecting change on the environmental context of the firm to increase the probability of an organization to innovate.

Specifically defined, the innovation capability consists of a description of the core capability and its primary characteristics. Each characteristic is described by observable attributes exhibited by the firm, measurable metrics of attribute existence and

Table 3 The IT innovation critical process in the IT-CMF

	Managing IT innovation	Funding the innovation portfolio	Executing the IT innovation capability	Assessing the value of IT innovation
5 Systemic innovation	Business transformation and agility	Self-sustaining	Culture drives continuous business innovation	Confidence in value return
4 Managed innovation	Aligned to strategic business needs	Co-funded with business	Routinely delivers innovative operational improvements	Reliable, consistent measurement
3 Defined innovation	Defined IT innovation strategy	Justified business spend	Tools, processes, organization supports value-chain innovations	Defined value assessment
2 Sporadic innovation	Emerging innovation strategy	One-time spend	Occasional product improvements	Informal value measurement
1 Initial/ad hoc innovation	Undefined innovation strategy	Not explicitly budgeted	Limited impact and scope of innovations	No recognized value

performance and expected impact on the firm's ability to increase the probability of innovative outcomes.

The IT innovation management critical capability, the first maturity level, describes the IT innovation capability in its most immature form. This capability is termed *initial*, where linear processes are unmanaged, and there is a poor understanding of the non-linear capabilities and social processes. In practice, there will be a limited adoption of new technologies and IT managers are, in general, unaware of the potential or existing benefits of IT innovations. The second maturity level describes a sporadically managed innovation capability. An emerging capability is characterized by a small group of IT managers who recognize the value of IT innovation and act in an uncoordinated manner to increase IT innovations. The third maturity level describes a defined innovation capability with a high degree of coordination. Linear processes are defined and executed upon to increase levels of innovation. Non-linear activities are encouraged through contextual investments. The fourth maturity level describes an actively managed innovation capability. IT and executive managers promote and coordinate innovation across the enterprise. The fifth maturity level describes a systemic innovation capability. IT innovations are recognized by the firm to contribute value to the enterprise, and the organization is active in encouraging innovation. The IT innovation critical process is shown in Table 3.

Now, we will propose some conclusions from our examination of the IT-CMF which has been developed using an R&D process.

Conclusions

Innovation is now a major focus for organizations, regions and economies, and the subject is increasingly seen as being crucial not only to success but to survival. Models

of innovation can be divided into two broad areas. The first area deals with design and development methodologies carried out within enterprises. The second area deals with the economic, institutional and social context of innovation dynamics. According to Brynjolfsson and Saunders (2009), the fundamentals of the world economy indicate that there will be a continuation of innovation "through the booms and busts of the financial markets and of business investments" (p. ix). R&D is the lifeblood of the innovation process, and it is increasingly being carried out in an international context driven by an *open* concept of innovation and the ubiquity of IT. Ward and Peppard (2002) suggest that researchers have "much to learn about how knowledge can be effectively managed before we can understand how best to deploy IT to improve the processes involved". The case study of the research and development of the IT-CMF has been examined through the lens of IT business value. Furthermore, the IT-CMF uses the following DSR patterns proposed in Vaishnavi and Kuechler (2007)

- *Different perspectives*: The research problem is examined from different perspectives, e.g. conceptual, strategic, organizational, technical and cultural.
- *Interdisciplinary solution extrapolation*: A solution or solution approach (i.e. methods, instructions, guidelines, etc.) to a problem in one discipline can be applied in or adapted to the integrated IT-CMF.
- *Building blocks*: The complex research problem of IT management is broken into 36 critical processes that are examined in turn.
- *Combining partial solutions*: The partial solutions from the building blocks are integrated into the overall IT-CMF, and the inter-dependencies between the building blocks are identified and highlighted. In order to rigorously demonstrate the utility of the developed artefact, different evaluation methods can be used. Amongst others, the *informed argument* is suggested as an appropriate evaluation method (Schön 1983).

The paper makes a contribution by providing an exemplar of R&D in the emerging area of business processes, a hitherto under-researched area compared with product and service R&D. It provides evidence, in the form of the IT-CMF case study, that information technology can support R&D in the important but relatively underdeveloped area of business process development. It also addresses recent work on the limitations of current research in the area (Schryen 2013). Implications for research concur with Neavel Dickens (1998) statement that "it will be important to include more practitioner voices in studies" (p. 257). It is argued that the case of the IVI can provide a rich and detailed format to present the voice of a number of international practitioners. This could be viewed as the project long perspective of developing an R&D framework together with lead users (von Hippel 2005).

Such underpinning is required to develop a strong research agenda, particularly in such nascent areas as business process innovation and in the related area of management innovation which is beginning to receive attention from scholars (Mol and Birkinshaw 2009).

According to Damanpour et al. (2009), innovation is a primary source of economic growth, industrial change and competitive advantage. Innovation research and development in the area of business processes is ripe for research stimuli which, we argue, requires to be underpinned by a strong theoretical basis. This study examined these

views using two approaches: by reviewing recent developments in the literature and by presenting an empirical study of R&D in an academic-practitioner organization that has an international reach. The review indicated that a growing body of literature points to innovation as the principal source of competitive advantage. In addition, the emerging models of *open innovation* posit that knowledge and resources increasingly reside outside the firm's locus of control. Future work is required to further develop the concept of research and development in the area of business processes. In his seminal paper, Wernerfelt (1984) commented that his work was meant "only as a first cut at a huge can of worms" (p. 180). We hope that our paper can stimulate some debate on the competitive advantage of business process R&D in an international context. Furthermore, we believe that our paper supports recent arguments that business models (BMs) need to move from being focused on the trade of goods and services to being focused on the trade of tasks (Carayannis et al. 2014). In our case, the *tasks* have been described in the innovation capability maturity framework which manages IT for business value. Future work is required to quantify the contribution of the innovation process using empirical studies of host companies.

References

Bannister, F. (2005). When paradigms shift: IT evaluation in a brave new world. *The Electronic Journal of Information Systems Evaluation, 8*(1), 21–30.

Barney, J. B., & Clark, D. N. (2007). *Resource-based theory: creating and sustaining competitive advantage*. Oxford: Oxford University Press.

Brynjolfsson, E., & Saunders, A. (2009). *Wired for innovation: how information technology is reshaping the economy*. Cambridge: MIT.

Carayannis, E. G., Grigoroudis, E., Sindakis, S., & Walter, C. (2014). Business model innovation as antecedent of sustainable enterprise excellence and resilience. *Journal of the Knowledge Economy, 5*(3), 440–463.

Carr, N.G. (2003). *IT doesn't matter*. Harvard Business Review, May 2003 edition.

Chamberlin, E. (1933). *The theory of monopolistic competition: a re-orientation of the theory of value*. Cambridge: Harvard University Press.

Clemons, E. K. (1986). Information systems for sustainable competitive advantage. *Information & Management, 11*(3), 131–136.

Coleman, T., & Jamieson, M. (1994). Beyond return on investment: evaluating ALL the benefits of information technology. In L. Willcocks (Ed.), *Information management, the evaluation of information systems investments* (pp. 189–206). London: Chapman Hall.

Cooper, R. G. (1994). New products: the factors that drive success. *International Marketing Review, 11*(1), 60–76.

Costello, G. J., & Donnellan, B. (2007). The diffusion of WOZ: expanding the topology of IS innovations. *Journal of Information Technology, 22*(1), 79–86. doi:10.1057/palgrave.jit.2000085.

Cross, N. (2000). *Engineering design methods: strategies for product design*. Chichester: Wiley.

Curley, M. (2004). *Managing information technology for business value: practical strategies for IT and business managers (IT best practices series)*. Intel.

Curley, M. (2007). *Introducing an IT capability maturity framework*. In keynote address at the International Conference for Enterprise Information Systems, ICEIS, Madeira, Portugal, 12–14 June 2007.

Damanpour, F., Walker, R. M., & Avellaneda, C. N. (2009). Combinative effects of innovation types and organizational performance: a longitudinal study of service organizations. *Journal of Management Studies, 46*(4), 650–675. doi:10.1111/j.1467-6486.2008.00814.x.

Dodgson, M., Gann, D., & Salter, A. (2005). *Think, play, do: technology, innovation, and organization*. Oxford: Oxford University Press.

Donnellan, B. (2004). 'IT systems to support innovation: an empirical analysis to support innovative product development in analog devices B.V.'. In B. Fitzgerald & E. Wynn (Eds.), *IT innovation for adaptability*

and competitiveness. Boston: Kluwer Academic.
IFIP TC8/WG8.6. Seventh working conference on IT innovation for adaptability and competitiveness, May 30–June 2, 2004, Leixlip, Ireland.
Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from national systems and "mode 2" to a Triple Helix of university–industry–government relations. *Research Policy, 29*(2), 109–123.
Feeny, D. F., & Ives, B. (1997). IT as a basis for sustainable competitive advantage. In L. P. Willcocks, D. F. Feeny, & G. Islei (Eds.), *Managing IT as a strategic resource* (pp. 43–63). London: McGraw-Hill.
Fichman, R. G. (2004). Going beyond the dominant paradigm for information technology innovation research: emerging concepts and methods. *Journal of the Association for Information Systems, 5*(8), 314–355.
Hammer, M. (1996). *Beyond reengineering: how the process-centred organisation is changing our work and our life*. New York: Harper Business.
Hammer, M., & Champey, J. (1994). *Re-engineering the corporation*. New York: Harper Business.
Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly, 28*(1), 75–105.
IVI (2013). Innovation Value Institute. Available online at www.ivi.ie. Accessed Feb 2013
Jeyaraj, A., Rottman, J. W., & Lacity, M. C. (2006). A review of the predictors, linkages, and biases in IT innovation adoption research. *Journal of Information Technology, 21*, 1–23.
Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard—measures that drive performance. *Harvard Business Review, 70*(1), 71–79.
Laudon, K. C., & Laudon, J. P. (2002). *Management information systems: managing the digital firm* (2nd ed.). New Jersey: Prentice Hall.
Leydesdorff, L. (2012). The triple helix, quadruple helix, …, and an N-tuple of helices: explanatory models for analyzing the knowledge-based economy? *Journal of the Knowledge Economy, 3*(1), 25.
Lundvall, B.-A. (1995). *National systems of innovation: towards a theory of innovation and interactive learning*. London: Pinter.
MacMillan, I. C. (1983). Preemptive strategies. *Journal of Business Strategy, 3*(2), 16–26.
March, S., & Vogus, T. (2010). Design science in the management disciplines. In A. Hevner & S. Chatterjee (Eds.), *Design research in information systems: theory and practice (integrated series in information systems)*. New York: Springer.
Markus, M. L., Majchrzak, A., & Gasser, L. (2002). A design theory for systems that support emergent knowledge processes. *MIS Quarterly, 26*(3), 179–213.
Mathiassen, L., & Nielsen, P. A. (2008). Engaged scholarship in IS research. *Scandinavian Journal of Information Systems, 20*(2), 3–20.
Mol, M. J., & Birkinshaw, J. (2009). The sources of management innovation: when firms introduce new management practices. *Journal of Business Research, 62*, 1269–1280.
Neavel Dickens, L. (1998). *A theory of action perspective of action research*. Unpublished thesis *Ph.D. Dissertation, University of Texas at Austin*.
O'Brien, J. A., & Marakas, G. M. (2009). *Management information systems*. Boston: McGraw-Hill Irwin.
Otto, K., & Wood, K. (2001). *Product design: techniques in reverse engineering and new product development*. New Jersey: Prentice Hall.
Pavitt, K. (2005). Innovation process. In J. Fagerberg, D. Mowery, & R. R. Nelson (Eds.), *The Oxford handbook of innovation*. Oxford: Oxford University Press.
Peppard, J., Ward, J., & Daniel, E. (2007). Managing the realisation of business benefits from IT investments. *MIS Quarterly Executive, 6*(1), 1–11.
Pfaffenberger, B. (2002). *Computers in your future*. Upper Saddle River: Prentice Hall.
Post, G. V., & Anderson, D. L. (2003). *Management information systems: solving business problems with information technology*. Boston: McGraw-Hill/Irwin.
Pugh, S. (1991). *Total design: integrated methods for successful product engineering*. Boston: Addison-Wesley.
Robson, W. (1997). *Strategic management and information systems: an integrated approach* (2nd ed.). London: Pitman.
Schön, D. A. (1983). *The reflective practitioner: how professionals think in action*. New York: Basic Books.
Schryen, G. (2013). Revisiting IS business value research: what we already know, what we still need to know, and how we can get there. *European Journal of Information Systems, 22*, 139–169. doi:10.1057/ejis.2012.45.
Published online 13 November 2012.
Simon, H. (1996). *The sciences of the artificial* (3rd ed.). Cambridge: MIT.
Strassmann, P. (1985). *Information payoff: the transformation of work in an electronic age*. New York: Free.

Swanson, E. B., & Ramiller, N. C. (2004). Innovating mindfully with information technology. *MIS Quarterly, 28*(4), 553–583.

Tarafdar, M., & Gordon, S. R. (2005). How Information Technology Capabilities Influence Organizational Innovation: Exploratory Findings from two Case Studies. In Proceedings of the 13th European Conference on Information Systems, Information Systems in a Rapidly Changing Economy. Regensburg, Germany: ECIS 2005, 26-28 May 2005.

Ulrich, K. T. & Eppinger, S. D. (2004). Product design and development, 3rd Edition. Boston: Irwin McGraw-Hill.

Vaishnavi, V., & Kuechler, W. (2007). *Design science research methods and patterns: innovating information and communication technology, journal of product innovation management*. New York: Auerbach.

Van de Ven, A. H. (2007). *Engaged scholarship: a guide for organizational and social research*. Oxford: Oxford University Press.

Venable, J. R. (2010) *Design science research post*. In: Hevner et al. (Eds.) *Criteria, standards, guidelines, and expectations*. Translated by Winter, R., Zhao, J. L. and Aier, S., Proceedings. Lecture Notes in Computer Science 6105, Springer, 109–123.

von Hippel, E. (2005). *Democratizing innovation*. Massachusetts: MIT.

Walls, J. G., Widmeyer, G., & Sawy, O. E. (1992). Building information system design theory for vigilant EIS. *Information Systems Research, 3*(1), 36–59.

Ward, J., & Peppard, J. (2002). *Strategic planning for information systems* (3rd ed.). Chichester: Wiley.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5*(2), 99–197.

Whelan, E. (2007). Exploring knowledge exchange in electronic networks of practice. *Journal of Information Technology, 22*, 5–12.

Wilson, J. Q. (1966). Innovation in organizations: notes toward a theory. In J. D. Thompson (Ed.), *Approaches to organizational design* (pp. 193–218). Pittsburgh: PA University of Pittsburgh Press.

Zaltman, G., Duncan, R., & Holbek, J. (1973). *Innovations and organizations*. New York: Wiley.