Examining the influence of modularity and knowledge management (KM) on dynamic capabilities: Insights from a call center

M.N. Ravishankar [a,*], Shan L. Pan [b]

[a] School of Business and Economics, Loughborough University, UK
[b] Department of Information Systems, School of Computing, National University of Singapore, Singapore

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ABSTRACT

Modularity in organizations can facilitate the creation and development of dynamic capabilities. Paradoxically, however, modular management can also stifle the strategic potential of such capabilities by conflicting with the horizontal integration of units. We address these issues through an examination of how modular management of information technology (IT), project teams and front-line personnel in concert with knowledge management (KM) interventions influence the creation and development of dynamic capabilities at a large Asia-based call center. Our findings suggest that a full capitalization of the efficiencies created by modularity may be closely linked to the strategic sense making abilities of senior managers to assess the long-term business value of the dominant designs available in the market. Drawing on our analysis we build a modular management-KM-dynamic capabilities model, which highlights the evolution of three different levels of dynamic capabilities and also suggests an inherent complementarity between modular and integrated approaches.

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1. Introduction

The *modular* design of systems, technologies and processes are now a preferred option for an increasing number of organizations (Hoetker, 2006; Salvador, 2007; Sanchez & Mahoney, 1996; Sinha & Van, 2005). According to Schilling and Steensma (2001) "systems are said to have a high degree of modularity when their components can be disaggregated and recombined into new configurations – possibly with new components – with little loss of functionality." Modularity offers a number of benefits such as strategic flexibility (Sanchez, 1997), cycle time reduction (Peters & Saidin, 2000; Ulrich & Eppinger, 1999), opportunities for outsourcing (Baldwin & Clark, 1997) and product innovation (Ethiraj & Levinthal, 2004). Modularity also makes it easier for resources to be more easily integrated, built and reconfigured. In short, it is believed that modular management of resources (or modularity) can facilitate the creation and development of unique sets of dynamic capabilities and ultimately deliver a sustainable competitive advantage to organizations (see Langlois, 2002; Worren, Moore, & Cardona, 2002).

When examining modular systems and dynamic capabilities, it is also important to note that the obvious benefits of modular designs and systems often come with a cost (Brusoni, 2005; Fleming & Sorenson, 2001). In a significant way, modularity may also have

a negative impact on strategies to build dynamic capabilities since modular approaches can create significant hurdles for 'horizontal integration' of business units. Horizontal integration is of special interest to senior managers since such it helps organizations reap the strategic benefits of co-ordination and knowledge sharing (Ndlela & du Toit, 2001). A critical component of horizontal integration, which may be affected, is 'intellectual integration' or the 'goal of knowledge management (KM)' (Ghoshal & Gratton, 2002). Indeed, many organizations have implemented organization-wide KM strategies in order to achieve a horizontally integrated organization (Ravishankar, Pan, & Leidner, 2011). Disaggregated and dispersed modular resources and systems clearly pose an important challenge for KM since they tend to operate as isolated entities making it difficult for the larger organization to integrate disparate pockets of knowledge (Ghoshal & Gratton, 2002; Ravishankar & Pan, 2008).

The wider IS literature clearly recognizes that effective KM strategies can contribute significantly to the development of dynamic capabilities (see Garud & Kumaraswamy, 2005; Massey, Montoya-Weiss, & O'Driscoll, 2002). Yet as noted above, by posing structural and social barriers to the integration of dispersed knowledge modular designs may indirectly create bottle necks for the development of dynamic capabilities. In other words, modularity may facilitate dynamic capabilities and paradoxically, also stifle their creation by visibly counteracting at least some of the aims of organizational KM strategies (see Brusoni, 2005). For most organizations, a resolution of these difficulties is of course not possible by choosing modularity over KM or vice versa, since in practice

* Corresponding author.
E-mail addresses: M.N.Ravishankar@lboro.ac.uk
(M.N. Ravishankar), pansl@nus.edu.sg (S.L. Pan).

both are critical strategies underpinning the creation of dynamic capabilities.

Drawing on these points of tension, we address two main research questions in our paper: (1) How does a modular approach to managing information technology (IT) and operations facilitate the creation and development of dynamic capabilities? (2) How can an effective organizational KM strategy counter the limitations of modularity? We address these questions through an in-depth qualitative case study of ASIASPEAK, a call center with operations in three Asian cities. The rest of the paper is organized as follows: The next section offers a brief review of the academic literature on modularity and its benefits, and organizational KM. This is followed by a description of the research methods and an analysis of modular management at ASIASPEAK. We conclude with a discussion of the key implications of our study.

2. Modularity

Modularity is the efficient organization of complex products and processes through a partitioning of information into "visible design rules" and "hidden design parameters" (Baldwin & Clark, 1997; Richard & Devinney, 2005). Visible design rules ("visible information") refer to structural decisions of design relating to the architecture, interfaces and standards, which affect subsequent modifications. Hidden design parameters ("hidden information") on the other hand, do not affect design decisions and can be changed without informing those outside the modular design (Baldwin & Clark, 1997). "A complex system is said to exhibit _modularity in design_ if its parts can be designed independently but will work together to support the whole" (Baldwin & Clark, 2006). Empirical studies have investigated modular designs, systems and approaches in a variety of new product development settings such as consumer electronics (Park, Fujimoto, & Hong, 2012), computer hardware (Quinn, 2000), aircraft manufacturing (Sosa, Eppinger, & Rowles, 2004), software products (MacCormack, Rusnak, & Baldwin, 2006) and car manufacturing (Cusumano & Nobeoka, 1998). Further, the benefits of integrating IT and modular designs in the development of new products has also been highlighted in recent empirical studies (for e.g., Liang & Huang, 2002; Park et al., 2012).

2.1. Modular management and dynamic capabilities

Dynamic capabilities refer to the organizational and strategic processes by which managers manipulate resources into new productive assets in changing markets (Galunic & Eisenhardt, 2001; McKelvie & Davidsson, 2009). Given the hypercompetitive business environments of today, dynamic capabilities are particularly crucial since resources that previously served as sources of competitive advantage can fast end up becoming liabilities (Johnson, Scholes, & Whittington, 2006; Newey & Zahra, 2009; Teece, Pisano, & Shuen, 1997). In response to the challenges of changing markets, organizations need to continuously create the capabilities of acquiring, developing and deploying relevant resources so that these capabilities may provide distinctive sources of advantage (Barney, 1991; Heracleous & Wirtz, 2010). Put differently, only organizations possessing such _dynamic capabilities_ will be able to adapt and thrive in hypercompetitive environments (Conner & Prahalad, 1996; Karim, 2006). Eisenhardt and Martin (2000) argue that dynamic capabilities' are particularly valuable because they alter the resource base: they create, integrate, recombine, and release resources. Dynamic capabilities are therefore seen to contribute to the competitive advantage of organizations by helping them to reconfigure their strategic resources and to develop certain unique capabilities faster (Pandza & Thorpe, 2009; Teece et al., 1997).

Modularity can potentially facilitate the creation and development of dynamic capabilities in a number of ways. Modularity improves _strategic flexibility_ or "the condition of having strategic options that are created through the combined effects of an organization's coordination flexibility in acquiring and using flexible resources" (Sanchez, 1997; Worren et al., 2002). In other words, modularity gives a system greater flexibility and makes it possible for its components to be recombined in different ways to provide different functions in organizational units (Sanchez, 1995; Shah, 2006). Modularity can help accelerate processes of organizational learning in relation to two distinct levels of organizational design and work: (1) the component level and (2) the architecture level (Garud & Kumaraswamy, 1995; Popadiuk & Choo, 2006; Sanchez & Mahoney, 1996). First, at the component level modularity allows localized adaptations to take place within hidden modules often leading to reduced design and development times (Ulrich & Eppinger, 1999). The specifications of the interface with other organizational modules and processes shields business units and teams from dramatic changes taking place in the organizational architecture, thereby allowing component-level learning mechanisms to retain their value and relevance (Richard & Devinney, 2005). Well-endowed modular university departments, whose internal processes and learning mechanisms remain relatively shielded from design changes taking place in the broader organizational architecture, are a good illustration. Ensuring that the interface to the architecture stays constant also makes it possible to accelerate learning processes by assigning several teams within a unit to work on different variations of the same component (Langlois, 2002). Second, the _loose coupling_ between the architectural and component learning processes helps accelerate learning at the broader architectural level as well (Sinha & Van, 2005). In short, a modular approach makes a clear distinction between organizational learning processes at the component and architectural levels. In doing so, it removes obstacles to innovation and leads to enhanced learning outcomes.

Modularity also allows organizations to better adapt to changing market opportunities through _patching_, a "strategic process by which corporate executives routinely remap businesses to changing market opportunities" through "adding, splitting transferring, exiting, or combining chunks of businesses" (Campbell, Eisenhardt, & Brown, 1999). For instance, reuse of existing tools may be facilitated in a big way by recombining or/and substituting one modular business with another (Ethiraj & Levinthal, 2004). Modular designs give organizations the strategic option of outsourcing modules, which can help managers focus more on core value-creating activities (Miozzo & Grimshaw, 2005; Quinn, 2000). For many organizations, modularity makes _information hiding_ (Parnas & Morris, 1972) possible since detailed knowledge about the inner workings of one component need not be shared with the makers of other components. A well-known consequence of information hiding in service industries (e.g., banks) is the ubiquitous frustrated customer who has to explain everything all over again on finding his/her phone call abruptly transferred to a customer service representative in a different department.

2.2. Modularity and the knowledge management (KM) problem

Clearly, although modular management brings many advantages, it can also introduce some difficulties. A review of the literature suggests that that over using modularity can lead to a lack of true breakthrough innovations (Fleming & Sorenson, 2003) with only incremental improvements occurring at the component level. An often-cited example in the popular media is that of IT vendor organizations in developing countries, whose modular systems are thought to facilitate small improvements in service offerings, while at the same time also stifling major innovations. Perhaps the most