Toward a Fitness Landscape Model of Firms' IT-Enabled Dynamic Capabilities

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INTRODUCTION

Scholars posit that information systems and information technology (IS/IT) are capable of revolutionizing the way firms operate, and hence drive a firm's performance under rapidly changing conditions (Agarwal & Selen, 2009; El Sawy, Malhotra, Park, & Pavlou, 2010; Kohli & Grover, 2008; R. Van de Wetering, Mikalef, & Pateli, 2017b). In understanding this particular role of IS/IT within the turbulent business ecosystem and landscape, previous studies have emphasized the importance of IS/IT in enabling organizational capabilities (Kohli & Grover, 2008). Organizational capabilities represent firms' potential to achieve specific business strategies and management objectives using focused deployment and are considered the building blocks on which firms compete within the business ecosystem (Barney, 1991). Firms that are capable of targeting and deploying IS/IT initiatives in support of these organizational capabilities are more likely to realize business value from their IT resource and IT competencies inventory (Sambamurthy, Bharadwaj, & Grover, 2003; R. Van de Wetering, Mikalef, & Pateli, 2017a). The extant literature refers to this specific capacity to effectively use IT functionalities to support IT-related activities as an IT leveraging competence (Pavlou & El Sawy, 2010).

The core principle of examining the particular value of IS/IT in enterprise processes it is embedded, i.e., IT-enabled capabilities is also highly encouraged in contemporary IS literature (Grover & Kohli, 2012; Kohli & Grover, 2008; Mikalef, Pateli, & van de Wetering, 2016). IT-enabled capabilities gained considerable as they collectively create business value and drive a firm's competitive edge (El Sawy & Pavlou, 2008; Mithas, Tafti, Bardhan, & Goh, 2012; Roberts, Galluch, Dinger, & Grover, 2012).

The capabilities we address in this current study constitute the dimensions of IT-enabled dynamic capabilities (ITDC). We define ITDCs as a firm's ability to leverage its IT resources and IT competencies, in combination with other organizational resources and capabilities, to address rapidly changing business environments (Mikalef et al., 2016). Based on the notion that firms must be able to be stable enough to continue to deliver value in their distinctive way, and agile and adaptive enough to restructure their value proposition when circumstances demand it, there is a well-documented distinction between ordinary (operational or zero-order) and these ITDCs (Drnevich & Kriauciunas, 2011; Mikalef et al., 2016; Pavlou & El Sawy, 2011; Winter, 2003). Ordinary capabilities enable a firm to make a living in the present, while ITDCs act as a continuous driver of evolution to changing business requirements (Winter, 2003). Thus, ITDCs help firms decision-makers in practice by extending, modifying, and reconfiguring existing operational capabilities into new ones that better match the environmental conditions.

There is overwhelming evidence concerning the impact of ITDCs on firm performance at an aggregate level (Mikalef & Pateli, 2017; Rai & Tang, 2010). However, there is still little consensus on how

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specific interrelations (e.g., too many or too little epistatic links and interdependency among individual capabilities) result in the achievement toward higher levels of performance and evolutionary fitness. Moreover, the extant literature has predominantly focused on the aggregate construct level of ITDCs.

Consequently, there is no clear overview of what constitutes useful configurations of the underlying interdependencies. A better understanding of the nature and role of ITDCs may have profound implications for theory and practice. In doing so, this study builds on the science of complexity recently become a significant focus of interdisciplinary research, also within the IS field (Benbya & McKelvey, 2006; Merali, Papadopoulos, & Nadkarni, 2012; R. Van de Wetering & Bos, 2016; Rogier Van de Wetering, Mikalef, & Helms, 2017; Walraven, Van de Wetering, Helms, Versendaal, & Caniëls, 2018). This chapter adopts a prominent model for studies in theoretical biology and population genetics, i.e., the so-called NK-model (S. Kauffman & Levin, 1987; S. A. Kauffman, 1993), that evolved into a valuable model to understand the antecedents of efficient, flexible, innovative and IT-enabled firms (Celo, Nebus, & Wang, 2018; Onik, Fielt, & Gable, 2017; Vidgen & Wang, 2006; Yuan & Jiang, 2015).

This study aims to address the previously outlined limitations in the literature by drawing on complexity science while simultaneously building on the foundations of ITDC. In doing so, this current study makes four main contributions. First, this chapter positions the science of complexity and evolutionary (simulation) models as a suitable 'lens' to study the behavior of firms' ITDCs. This lens has also been advocated by recent studies (Kay, Leih, & Teece, 2018; Onik et al., 2017). Second, following Kauffman's work (S. Kauffman & Levin, 1987; S. A. Kauffman, 1993; S. A. Kauffman & Weinberger, 1989) this study designs the NK-model and stochastically generate fitness landscapes using the five ITDCs as core elements of the model, and 'K' complex interactions between those five, i.e., the interdependency (epistasis). Third, firms' effort is simulated to adaptively explore and walk through a generated fitness landscape of possible strategies of interrelated ITDCs to change and move toward higher levels of fitness of ITDCs. Finally, this chapter identifies which degree of epistasis on average leads to optimal fitness values and hence firms' competitive performance.

Outcomes of our work provide new empirical support for possible business strategies that can be employed considering a firm's current status and interdependency among its ITDCs[1]. To our knowledge, no scholarship is available that identifies these specific interactions among the different ITDCs and uses the NK-model to do so.

The remainder of this chapter is structured as follows. First, this chapter reviews the fitness landscapes theory and Kauffman's NK-model. Next, our methods section is outlined including the simulation model parameters, and the outcomes follow this section. This chapter ends with a discussion, including inherent limitations of this study as well as future research opportunities, and concluding remarks.

THEORETICAL BACKGROUND

Complexity science addresses the summon of adopting a dynamic methodological approach, in which scholars and practitioners are equipped with adequate assessment tools and mechanisms for examining the processes when IT and associated capabilities add value (Rogier Van de Wetering et al., 2017). This paper draws upon foundational and empirical work and presents, extends and integrates a complex adaptive systems perspective and applies this to the firm's ITDCs.

The NK model from population genetics and theoretical biology (S. Kauffman & Levin, 1987; S. A. Kauffman, 1993; S. A. Kauffman & Weinberger, 1989) has become a particularly popular reference model for studying strategy, organizational, and innovation problems and challenges through the use

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