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Research Paper

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Abstract

A question of central importance for researchers and practitioners is whether Information Technology (IT) can help build a competitive advantage in constantly changing environments. One characteristic of a firm's IT infrastructure in particular, flexibility, has been posited as being a critical enabler in attaining competitive performance gains. Yet, despite this suggestion, there is scarce empirical evidence to support this claim, and even more, a lack of understanding of the mechanisms through which flexible IT infrastructure add value. Grounded on modular systems theory and the dynamic capabilities view of the firm, the notion of IT-enabled dynamic capabilities is put forth which emphasizes the key areas in which IT investments must be leveraged. A conceptual model is then developed to explain how IT flexibility leads to competitive performance gains. To test our hypotheses, a PLS-SEM analysis in performed on a sample of 274 international firms. Outcomes suggest that IT flexibility acts as an antecedent of IT-enabled dynamic capabilities, and that this association is positively moderated by decentralizing IT governance. The formation of IT-enabled dynamic capabilities is found to be an important driver for competitive performance. Results are discussed, while theoretical and practical implications are highlighted.

Keywords: Dynamic Capabilities, IT Flexibility, IT Governance, Modular Systems

1 Introduction

The relationship between Information Technology (IT) and a firm's competitive performance is a crucial topic that has dominated information systems research over the past couple of decades (Tanriverdi et al., 2010; Kim et al., 2011). Scholars have coined the term IT capabilities in an attempt to measure a firm's proficiency in exploiting its IT assets. According to Bharadwaj (2000), an IT capability is not so much a specific set of technological functionalities as it is an enterprise-wide capability to leverage technology to differentiate from competition. Many studies have attempted to understand the role of IT in reinforcing a firm's competitive position, with a growing body of literature emphasizing the importance of IT capabilities in transforming IT resources and IT competencies into differential business value (Kohli & Grover, 2008; Pavlou & El Sawy, 2010; Kim et al., 2011; Joshi et al., 2011). Still, IT capabilities are merely conceptualized as an aggregation of IT resources and IT competencies in the vast majority of empirical studies (Wade & Hulland, 2004). Recent commentaries argue that instead of trying to determine what combinations of IT resources and IT competencies firms should aim for, it is more pertinent to identify the organizational capabilities that IT should be targeted in enabling or strengthening (Kohli & Grover, 2008; Tanriverdi et al., 2010; Kim et al., 2011).

Grounded on this logic, the purpose of this research is to examine IT capabilities as dynamic capabilities, hereafter mentioned as IT-enabled dynamic capabilities. IT-enabled dynamic capabilities are defined as a firm's ability to leverage its IT resources and IT competencies, in combination with other organizational resources and capabilities, in order to address rapidly changing business environments. The aim of this study is to investigate if IT architecture flexibility facilitates the formation of IT-enabled dynamic capabilities, as well as if the development of IT-enabled dynamic capabilities results in any significant competitive performance gains. The main thesis is that a flexible IT infrastructure will only be of value if leveraged appropriately to support or enable critical organizational capabilities that work towards dynamic strategic alignment (Chung et al., 2003). IT-enabled dynamic capabilities therefore reflect a firm's capacity to utilize its IT infrastructure to support evolutionary fitness with the external environment (Helfat & Peteraf, 2009). The dynamic capabilities view of the firm is deemed as an appropriate theoretical framework to explain how firms differentiate and compete, taking into account that firms must evolve and reconfigure their operations in order to remain competitive. In contrast with the resource based view of the firm that largely disregards the impact of the external environment, the dynamic capabilities view emphasizes on activities that range from incremental adjustments to radical reconfigurations and alterations when the situation or need arises (Ambrosini et al., 2009).

Our research therefore aims to contribute in three aspects. First, it identifies the areas in which IT should be leveraged guided theoretically by advancements in dynamic capabilities literature. The idea of examining the value of IT in the processes it is embedded, i.e. IT-enabled capabilities, is highly encouraged in contemporary IS literature (Kohli & Grover, 2008). Second, it explains how IT architecture flexibility, in combination with a decentralized IT governance scheme, can aid towards the formation of IT-enabled dynamic capabilities. Specifically, it examines modularity as a principle of design and structure, and its impact on the formation of IT-enabled dynamic capabilities. Third, it demonstrates that although IT infrastructure flexibility and IT governance decentralization may be important in realizing competitive performance gains, their impact is indirect. Thus, we explore the competitive performance gains that stem from the presence of strong IT-enabled dynamic capabilities.

2 Theoretical Background

Many studies have attempted to understand the role of IT in reinforcing a firm's competitive position, with a growing body of literature emphasizing on the importance of IT in enabling organizational capabilities (Kohli & Grover, 2008). The processes of rooting IT into organizational capabilities serves as a leveraging mechanism of existing IT resources and IT competencies. Thus, firms that are able to effectively target IT initiatives in support of organizational capabilities are more likely to realize value from their IT resource and IT competencies inventory (Sambamurthy et al., 2003). Pavlou and El Sawy (2006) refer to this capacity of effectively implementing IT functionality in support of an organizational capability as an IT leveraging competence. They argue that it constitutes the primary source of competitive differentiation. Previous research in the area of strategic management has made great advancements to develop and refine the different types of capabilities that exist, since it is generally accepted that not all organizational capabilities result in the same level of competitive performance gains (Schilke, 2014).

2.1 The Dynamic Capabilities View

Of particular relevance for contemporary firms are what strategic management literature term as dynamic capabilities. The Dynamic Capabilities View (DCV) has emerged as one of the most influential theoretical perspectives in the study of strategic management over the past decade, and attempts to explain the processes through which a firm evolves in changing environments and maintains sustained competitive advantage (Priem & Butler, 2001; Schilke, 2014). The main premise of the DCV, which originates from the 'Schumpeterian logic of creative destruction', is that dynamic capabilities enable firms to integrate, build, and reconfigure resources and competencies in the face of changing conditions. Although the conceptualization of dynamic capabilities may seem abstract, a growing consensus in literature describes them as a set of identifiable and specific routines that often have been subject of extensive empirical research in their own right (Eisenhardt & Martin, 2000). This approach seems to be gaining ground in empirical studies, since it is feasible to identify and prescribe a set of operating routines that jointly constitute firm-level dynamic capabilities (Zollo & Winter, 2002). To isolate the main routines that underpin dynamic capabilities and empirically measure them, past empirical studies have relied on the definitions of Teece et al. (1997) (reconfiguring, learning, integrating, and coordinating), and Teece (2007) (sensing the environment to seize opportunities and reconfigure assets). Following the approach described above, existing literature suggests that dynamic capabilities comprise of the following routines: (i) sensing, (ii) coordinating, (iii) learning, (iv) integrating, and (v) reconfiguring (Pavlou & El Sawy, 2011; Protogerou et al., 2012; Wilden et al., 2013).

Although IS researchers recognize that IT investments *per se* do not result in any significant performance gains, but rather, are a result of leveraging IT investments strategically to support or enable organizational capabilities, few studies to date actually follow this "process-based" approach (Kohli & Grover, 2008; Kim et al., 2011). Building on the shortcomings of extant literature and on the theoretical developments of dynamic capabilities and modular systems theory, the purpose of this research is to examine how certain characteristics of IT resources and IT governance structures facilitate the formation of IT-enabled dynamic capabilities, as well as their potential business value. In effect, IT-enabled dynamic capabilities represent a mediating condition, describing the core areas in which IT resources must be leveraged. This perspective however does not diminish the importance of IT resources, since the type of IT resources that a firm owns, and the governance structures through which they are managed, may enable or inhibit the possible configurations it can achieve through them, and thus, the number of competitive actions (Sambamurthy et al., 2003).

2.2 Modular Systems Theory

In an attempt to describe why some systems migrate towards increased modularity, as well as what aspects underlie modular systems, Schilling (2000) proposed a general modular systems theory. According to the general modular systems theory, many systems opt towards modular forms in order to enable greater agility in end configurations. This tendency is necessitated by frequent changes in the environment (D'Aveni & Ravenscraft, 1994). The assumption is that many complex systems adapt or evolve in response to changes in their context, thus, increasing independency between sub-systems will lower the need for coordinated changes in others. A system may adapt purposefully, as when organizations alter themselves to better seek value (Kim & Pae, 2007). To enable agile and timely organizational and strategic responses, scholars advocate the use of modular design principles at multiple levels (Levinthal, 1997). In fact, strategic management literature posits that in the formation of dynamic capabilities, modularity represents a core principle (Sinha & van de Ven, 2005; Ravishankar & Pan, 2013). Modularity is a characteristic which largely determines the effectiveness in implementing continuous change, and is suggested to be an antecedent of dynamic capabilities (Pil & Cohen, 2006). Yet, modularity is not restricted to the design of systems, but also pertains to organizational arrangements of decision making. Teece (2007) argues that a modular organizational structure, in the form of decentralized decision making and local autonomy, drives the development of dynamic capabilities. Decentralization helps build dynamic capabilities, since it brings management close to new technologies, customers, and the market (Teece, 2007). In this way decentralization enables flexibility in scanning the environment, evaluating market and competition, and quickly accomplishing reconfiguration and transformation of operations ahead of competition (Teece & Pisano, 1994).

Abstracting these concepts to the IS domain, modularity has been examined as the flexibility of the IT architecture and the decentralization of the IT governance structure (Byrd & Turner, 2000), and has emerged as a key competitive priority in many organizational activities (Ray et al. 2005). IT flexibility is regarded as a critical characteristic of an IT infrastructure that can potentially influence a firm's ability to use and reconfigure IT strategically (Bharadwaj, 2000, Ray et al. 2005; Bhatt & Grover, 2005). IT flexibility has also been linked to increased levels of strategic alignment under circumstances that require agile and swift responses by the firm (Tallon & Pinsonneault, 2011). This demonstrates that a flexible IT infrastructure can facilitate a timely response in terms of IT-based competitive actions, geared towards sustained competitive advantage (Overby et al., 2006). In this respect, the IT infrastructure is not only used to support current operations, but is developed on the basis of constant adaptations, or as referred to, a platform for digital options (Overby et al., 2006).

A complementary facet of modularity, and an equally important antecedent of dynamic capabilities development, is governance structure (Teece, 2007). A modular organization structure is one in which decision making is intentionally decentralized among departments (Karim, 2006). In the context of IT decision making, this is presented as IT governance decentralization, an aspect also noted in Byrd's & Turner's conceptualization of IT flexibility. Centralization and decentralization represent two ends of a continuum, since IT decision rights are usually shared between the corporate IT unit and the line functions units (Tiwana & Konsynski, 2010; Mikalef et al., 2014). A centralized IT governance structure therefore is present when design authority resides primarily with a central corporate IT unit, whereas a decentralized decision-making structure is present when decision authority resides primarily with business units (Boh & Yellin, 2006). Centralizing IT governance facilitates greater efficiencies of economies of scale, while decentralization provides local control and ownership of resources and better responsiveness to business unit needs (Boh & Yellin, 2006).

3 Research Model

An organizations IT architecture refers to the arrangement through which various software applications and subsystems are interlinked (Kruchten et al., 2006). According to the definition of Byrd and Turner (2000), the degree of shareability and reusability of an IT architecture define what is known as IT flexibility. In essence, the principles that underlie the notion of IT flexibility are grounded on the ideas put forth in modular systems theory (Tiwana & Konsynski, 2010). Past studies have defined and subsequently refined technical IT infrastructure flexibility through the qualities of loose coupling, standardization and transparency (Duncan, 1995; Byrd & Turner, 2000; Joachim et al., 2013; Tafti et al., 2013). Chanopas et al. (2006) extended these works and proposed another dimension, scalability, as an important facet of IT flexibility.

Loose coupling refers to the degree to which it is possible to add, modify, and remove any software, hardware, or data components of the infrastructure with ease and with no major overall effect. Loose coupling ultimately enables the firm to decompose the IT architecture into atomic, fine-grained units of functionality, referred to as software components, modules, objects, or services. These atomic functionalities can then be easily recombined and restructured to quickly construct new solutions (Tafti et al., 2013). Standardization refers to the degree to which a firm's standards and policies establish how applications connect and interoperate with each other (Weill & Ross, 2005). An important evolution in terms of standardization is the adoption of open standards instead of proprietary or bilaterally established standards. Proprietary standards can lead to inflexibility in connecting of switching to new partners, whereas open standards allow for greater flexibility in establishing automated communication between firms (Zhu et al., 2006). Transparency refers to the degree to which data and system interfaces are visible, accessible, and deployable across different functions within the firm and outside its boundaries (Tafti et al., 2013). Transparency builds on prior related work of information systems that describes digital reach (Sambamurthy et al., 2003), data transparency (Byrd & Turner, 2000), and discoverability (Erl, 2008). This characteristic allows the service consumer to invoke a service regardless of its actual location in the network (Pautasso et al., 2008). Scalability refers to the degree to which hardware/software can be scaled and upgraded on existing infrastructure in order to handle larger volumes of users, workload, or transaction volume (Kumar, 2004; Chanopas et al., 2006). Infrastructures that support scalability also handle the problem of rapidly increasing complexity, when a rising number of systems need to be integrated (Papazoglou & van den Heuvel, 2007).

Although each individual dimension of IT flexibility may to some extent strengthen a firm's armory of digital options, it is conceivable that these dimensions in isolation may not be sufficient to drive IT-enabled dynamic capabilities. The combined effect of the underlying dimensions of IT flexibility enable a firm to develop the IT-enabled dynamic capabilities that are necessary to cope with changing conditions. Since the processes that underlie IT-enabled dynamic capabilities are built on digital infrastructures, modifying interconnected, customized IT application is difficult and time consuming. A flexible IT architecture can mitigate these bottlenecks and inertia issues in multiple ways. For instance, the cost and time required to form new partnerships or develop digital links within the firm are considerably lower when applications are loosely coupled and less constrained by dependencies with others (Tafti et al., 2013). In addition, using open standards for information system interfaces and data, can structure the information exchanged and automate communication. Thus, time-consuming iterations and overt coordination amongst the line functions that applications span can be significantly reduced (Tiwana & Konsynski, 2010). Transparency promotes the processes necessary for alliance and collaborative work formation, since it exposes the mutual capabilities amongst partners creating as such opportunities for joint development (Hagel & Brown, 2001). Finally, a scalable IT infrastructure allows for easier handling of large amounts of data, workload in transaction volumes, and users. Hence, scalability provides the fluidity to cope with peaks due to changing business conditions. Based on the foregoing discussion, we expect that greater IT flexibility will enhance the formation of IT-enabled dynamic capabilities.

H1: *IT flexibility has a positive impact on IT-enabled dynamic capabilities*

Although IT architecture flexibility is argued to enhance the formation of IT-enabled dynamic capabilities, the value-adding properties are amplified when this is complemented with a decentralized IT governance structure. In congruence with what is also argued by Teece (2007), business units are usually more alert of operational realities, and are therefore better positioned to recognize opportunities and problems that IT solutions can help them address (Sambamurthy & Zmud, 2000). By decentralizing the IT governance, business units are empowered to initiate changes that support existing applications or deploy new ones to address emerging opportunities. For instance, a firm may need to incorporate new suppliers to introduce a new product to the market. Such an action would require that efficient coordination mechanisms are established, IT applications that support collaborative work are deployed, and repositories and structures for storing and disseminating newly acquired or co-developed knowledge are assimilated. Despite IT governance decentralization being more efficient and effective in rapidly deploying solutions that match these needs, an absence of a flexible IT infrastructure may diminish a successful reaction (Mikalef & Pateli, 2011). Therefore, IT governance is argued to exert a positive moderating impact in the presence of flexible IT architectures. Overall, the combined effect of alertness by decentralizing IT governance, and versatility offered by flexible IT architectures, is posited to enhance a firms' IT-enabled dynamic capabilities.

> ***H2:*** *IT governance decentralization positively moderates the effect of IT flexibility on IT-enabled dynamic capabilities*

Realizing competitive performance gains in the contemporary business environment requires that firms are able to adapt to changes that have an impact on their functioning. Grounded on the dynamic capabilities view, IT-enabled dynamic capabilities are posited as being necessary in order to sense changing conditions and react appropriately to opportunities and threats (Mikalef, 2014). More specifically, IT-enabled sensing capabilities can help gain rich knowledge through processes of real time monitoring, pattern recognition, and strategic scenario modeling (Overby et al., 2006). Additionally, IT-enabled dynamic capabilities enable firms to communicate and exchange knowledge with partners, and more precisely capture shifting customer demands, thereby expanding their knowledge reach (Ray et al., 2005). This newly derived knowledge on customer purchase behavior can help managers identify new profitable market segments before competitors (Bughin et al., 2010). IT-enabled capabilities of coordination and learning foster the efficient generation, dissemination, and responding to market intelligence, allowing a firm to introduce products that better correspond to changing customer demands while simultaneously reducing reaction times (Swafford et al., 2008). These IT-enabled capabilities facilitate the deployment of the required processes that help break down organizational silos, promoting the transfer and recombination of knowledge across functional units (Fosfuri & Tribo, 2008; Liu et al., 2013). Entering new markets or modifying existing product, however, often requires opting for a different set of partners and collaborators. An IT-enabled integration capability forms the basis for acquiring, transforming, mixing, and matching objects across firms and business partners (Saraf et al., 2007), while an IT-enabled reconfiguration capability facilitates the modification of operations in an agile manner (Ngai et al., 2011).

> ***H3:*** *IT-enabled dynamic capabilities have a positive impact on competitive performance*

4 Methodology

4.1 Data Collection

A survey was developed and administered to key informants within firms to collect data and measure the constructs in the research model. Since high level executives are the typical employees that are aware of technical and business aspects contained in the survey, they constituted the main target respondents. Amongst others, key informants included Chief Information Officers (CIO), IT managers, Chief Technology Officers (CTO), enterprise architects, and Chief Executive Officers (CEO). A population of 1300 firms was randomly selected from the ICAP business directory, comprising of firms from almost all sectors. To assure a collective response, the instructions asked executives to consult other members of their firm for information they were not highly knowledgeable about. The duration of the data gathering process was approximately four months (January 2015 – May 2015). A total of 291 firms accepted to participate in the study providing 274 usable questionnaires yielding a valid response rate of 21.07%, which is consistent with comparable studies using key informant methodology (Capron & Mitchell, 2009). The response rate grouped by firm size-class was, 39% large (250+ employee), 20% medium (50 – 249 employees), 25% small (10 - 49 employees) and 16% micro (1 - 9 employees). The industry in which these firms operated are presented in Table 1.

Industry	N
Consulting services	70
High-tech	69
Financials	36
Consumer goods	25
Telecommunications	16
Industrials	16
Consumer services	14
Other (Basic materials, Healthcare, Utilities, Oil & gas, Transportation, Education)	28
Total	**274**

Table 1. Industry Distribution of the Sample.

Since non-response bias is a common problem in large scale survey studies, actions were taken both during the data collection to ensure a representative response rate, as well as after its completion to validate the absence of bias. To provide an incentive for participating in the study, during the data collection phase respondents were promised personalized reports benchmarking their firms' performance in various functional areas to industry averages (Sax et al., 2003). After the initial invitation to participate in the survey, three email reminders were sent out with a three-week interval between them. Following the completion of the data collection phase, early and late responses were compared to confirm that respondents did not differ significantly in their answers. Two groups of responses were selected, those that replied within the first three weeks, and those that answered within the final three weeks. For each construct used in the study, t-test comparisons were performed between group means, with results indicating no significant differences amongst them, thus indicating an absence of non-response bias. In addition, no significant differences were identified between responding and non-responding firms with regard to their age, size, and ownerships type (private or public). Given that all data were perceptual and collected from a single source at one point in time, common method bias was controlled in accordance with suggestions of Chang et al. (2010). *Ex-ante*, respondents were assured that data collected would remain anonymous and would be analyzed for research purposes solely at an aggregate level. *Ex-post*, Harman's one factor test was used, indicating that one construct did not account for the majority of variance. To perform Harman's one factor test, we loaded all items on to one construct in an Exploratory Factor Analysis (EFA) and examined if the un-rotated solution accounted for the majority of variance.

4.2 Constructs and Items

IT Flexibility

IT flexibility is defined as the degree of decomposition of an organization's IT portfolio into loosely coupled subsystems that communicate through standardized interfaces. It is developed as type II second order construct (first-order reflective and second-order formative), with first-order dimensions being, *loose coupling*, *standardization*, *transparency*, and *scalability*. Each of the dimensions that comprise IT flexibility is measured based on past empirical work (Byrd & Turner, 2000; Chanopas et al., 2006; Tiwana & Konsynski, 2010; Tafti et al., 2013). The selection of items was done on the basis that they had been validated in prior empirical studies and were suitable at a firm-level analysis. Specifically, respondents were asked to evaluate on a 7-point likert scale how much they agreed or disagreed (1 – totally disagree 7 – totally agree) with the statements presented in Table 2. The responses show that firms have invested mostly in the scalability of their IT infrastructure, which can be assumed to be due the adoption of cloud services.

Construct & Items	Items Loadings	Mean	Standard Deviation
Loose Coupling (LC)			

[LC1]	Our information systems are highly modular.	.866	5.05	1.13
[LC2]	The manner in which the components of our information systems are organized and integrated allows for rapid changes.	.869	4.83	1.41
[LC3]	Functionality can be quickly added to critical applications based on end-user requests.	.821	4.83	1.52
[LC4]	Exchanging or modifying single components does not affect our IT infrastructure.	.844	4.84	1.59
[LC5]	Organizational IT infrastructure and applications are developed on the basis of minimal unnecessary interdependencies.	.818	4.67	1.47
[LC6]	Organizational IT infrastructure and applications are loosely coupled.	.783	4.59	1.50
Standardization (STND)				
[STND1]	We have established corporate rules and standards for hardware and operating systems to ensure platform compatibility.	.812	5.17	1.54
[STND2]	We have identified and standardized data to be shared across systems and business units.	.839	4.99	1.51
[STND3]	Our systems are developed based on specifications that enable electronic links to external parties.	.728	4.80	1.66
[STND4]	Organizational IT infrastructure are developed based on compliance guidelines.	.891	5.20	1.56
[STND5]	Organizational IT applications are developed based on compliance guidelines.	.872	5.09	1.62
Transparency (TRNS)				
[TRNS1]	Remote users can seamlessly access centralized data and processes.	.793	5.34	1.61
[TRNS2]	Our user interfaces provides transparent access to all platforms and applications.	.881	5.20	1.51
[TRNS3]	Software applications can be easily transported and used across multiple platforms.	.850	4.67	1.59
[TRNS4]	Data of one system can be easily used in other systems.	.793	4.75	1.60
[TRNS5]	Our firm offers multiple interfaces or entry points (e.g., web access) to external users	.777	4.91	1.68
Scalability (SCAL)				
[SCAL1]	Our IT infrastructure easily compensates peaks in transaction volumes.	.899	5.26	1.43
[SCAL2]	Our information systems are scalable.	.933	5.49	1.38
[SCAL3]	Our IT infrastructure offers sufficient capacity in order to fulfill additional orders.	.937	5.51	1.38
[SCAL4]	The performance of our IT infrastructure completely fulfills our business needs regardless of usage magnitude.	.867	5.23	1.47

Table 2. Items and descriptive statistics of IT Flexibility.

IT Governance Decentralization

IT governance is defined as the distribution of IT decision-making rights and responsibilities amongst enterprise stakeholders, and the procedures and mechanisms for making and monitoring strategic decisions regarding IT (Boh & Yellin, 2007). IT governance is measured on the continuum of centralization-decentralization, as a first-order reflective latent construct comprising of 3 items. Respondents were asked to evaluate on a 5-point likert scale the degree to which decision making rights for a number of IT-related services reside primarily in a centralized corporate IT group or are decentralized amongst lines of business (1 - Centralized in corporate IT group 5 – Decentralized in lines of business). The IT services which they were asked to evaluate are presented in Table 3, in which it is apparent that the tendency is to opt for a hybrid mode of IT governance where decision rights are neither fully centralized nor decentralized.

Construct & Items		**Items Loadings**	**Mean**	**Standard Deviation**
IT Governance (GOV)				
[GOV1]	Infrastructure planning and management.	.853	3.90	1.01
[GOV2]	Application development, project prioritization and approval.	.926	4.12	1.09
[GOV3]	IT development and implementation.	.909	4.13	1.10

Table 3. Items and descriptive statistics of IT Governance Decentralization.

IT-Enabled Dynamic Capabilities

IT-enabled dynamic capabilities were measured as a Type II second order construct (reflective first-order, formative second-order), comprised of five first order constructs. The dimensions that comprise IT-enabled dynamic capabilities are adapted measures of: (1) sensing, (2) coordinating, (3) learning, (4) integrating, and (5) reconfiguring routines (Pavlou & El Sawy, 2011; Protogerou et al., 2012). Since the construct of IT-enabled dynamic capabilities is a novel one, past empirical literature was referenced to create adapted measures. Literature from the areas of strategic management, information systems, and organizational science literature were used to formulate adapted items as presented in Table 4. The construct was then validated through several expert group tests, as well as through a small population study in accordance with the guidelines of MacKenzie et al. (2011). Respondents were asked to evaluate on a 7-point likert scale (1-Not effective at all, 7-Highly effective) how effective their company was in using its IT systems to strengthen several capabilities. The mean scores for almost all items demonstrate that the use of IT to support or enable various capabilities is considerably strong. This is particularly the case when it comes to coordinating and learning activities.

Construct & Items		**Items Loadings**	**Mean**	**Standard Deviation**
Sensing (SNS)				
[SNS1]	Scanning the environment and identifying new business opportunities.	.835	4.88	1.51
[SNS2]	Reviewing our product development efforts to ensure they are in line with what the customers want.	.854	5.06	1.36
[SNS3]	Implementing ideas for new products and improving existing products or services.	.858	5.29	1.32
[SNS4]	Anticipating discontinuities arising in our business domain by developing greater reactive and proactive strength.	.881	4.82	1.32
Coordinating (CRD)				
[CRD1]	Providing more effective coordination among different functional activities.	.883	5.12	1.35
[CRD2]	Providing more effective coordination with customers, business partners and distributors.	.830	5.24	1.20
[CRD3]	Ensuring that the output of work is synchronized with the work of other functional units or business partners.	.864	5.03	1.30
[CRD4]	Reducing redundant tasks, or overlapping activities performed by different operational units.	.817	4.90	1.48
Learning (LRN)				
[LRN1]	Identifying, evaluating, and importing new information and knowledge.	.916	5.14	1.40
[LRN2]	Transforming existing information into new knowledge.	.935	5.01	1.34

[LRN3]	Assimilating new information and knowledge.	.936	5.09	1.38
[LRN4]	Using accumulated information and knowledge to assist decision making.	.886	5.08	1.35
Integrating (INT)				
[INT1]	Easily accessing data and other valuable resources in real time from business partners.	.838	4.92	1.43
[INT2]	Aggregating relevant information from business partners, suppliers and customers. (e.g. operating information, business customer performance).	.912	4.99	1.37
[INT3]	Collaborating in demand forecasting and planning between our firm and our business partners.	.865	4.68	1.49
[INT4]	Streamlining business processes with suppliers, distributors, and customers.	.865	4.87	1.40
Reconfiguring (REC)				
[REC1]	Adjusting for and responding to unexpected changes easily.	.871	4.82	1.37
[REC2]	Easily adding an eligible new partner that you want to do business with, or removing ones which you have terminated your partnership.	.832	4.95	1.41
[REC3]	Adjusting our business processes in response to shifts in our business priorities.	.915	4.91	1.33
[REC4]	Reconfiguring our business processes in order to come up with new productive assets.	.920	4.74	1.40

Table 4. Items and descriptive statistics of IT-Enabled Dynamic Capabilities.

Competitive Performance

Competitive performance refers to the degree to which a firm performs better than its key competitors (Rai & Tang, 2010). Specifically, respondents were asked to evaluate on a 7 point likert scale (1 – much weaker than competition, 7 – much stronger than competition) the relative performance of their firm in a number of key performance indicators (Rai & Tang, 2010; Li & Zhou, 2010; Liu et al., 2013). Following the argument that competitive advantage can be measured by subjective data, this study operationalized the construct as a formative latent variable comprising of 10 indicators as illustrated in Table 5 (Spanos & Lioukas, 2001). The construct composition and accompanying items were based on the rationale of including financial, operational, market, and customer-related indicators, therefore capturing the full extent of performance measures. Respondents were asked to evaluate on a 7-point likert scale (1 – totally disagree 7 – totally agree) the extent to which they believed that their firm performed better than their main competitors in the following aspects.

Construct & Items		**Items Loadings**	**Mean**	**Standard Deviation**
Competitive Performance (CP)				
[CP1]	Return on investment (ROI)	.772	4.63	1.45
[CP2]	Profits as percentage of sales	.768	4.54	1.42
[CP3]	Decreasing product or service delivery cycle time	.761	4.41	1.57
[CP4]	Rapid response to market demand	.852	4.72	1.67
[CP5]	Rapid confirmation of customer orders	.815	4.80	1.61
[CP6]	Increasing customer satisfaction	.799	5.01	1.62
[CP7]	In profit growth rates	.831	4.52	1.50
[CP8]	In reducing operating costs	.702	4.73	1.29
[CP9]	Providing better product and service quality	.829	5.01	1.70
[CP10]	Increasing our market share	.788	4.85	1.62

Table 5. Items and descriptive statistics of Competitive Performance.

4.3 Measurement Model

First-order reflective latent variables were subjected to reliability, convergent validity, and discriminant validity tests through the software package SmartPLS 2.0 (Ringle et al., 2005). Reliability was gauged at the construct and item level. Construct reliability was established by examining that all Cronbach Alpha (CA) values were above the threshold of 0.70 (Nunnally, 1978). Item reliability was assessed by examining if construct-to-item loadings were above the threshold of 0.70. Items with lower loadings were omitted from the measurement model. Convergent validity was assessed by examining if AVE is above the lower limit of 0.50 (Fornell & Larcker, 1981). The lowest AVE value was 0.62 which greatly exceeds the threshold. Discriminant validity was established through two methods. The first method examined if each constructs square root AVE was greater than its highest correlation with any other construct (Fornell-Larcker criterion). The second checked that each indicators outer loadings on its assigned construct was greater than its cross-loadings with other constructs (Farrell, 2010). These results support the appropriateness of the first-order reflective measures and suggest that all items are good indicators for their respective latent variables (Ruiz et al., 2008).

	1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**
1. Loose Coupling (LC)	**.83**										
2. Standardization (STND)	.46	**.82**									
3. Transparency (TRNS)	.69	.56	**.82**								
4. Scalability (SCAL)	.64	.65	.69	**.90**							
5. IT Governance (GOV)	.36	.45	.38	.41	**.89**						
6. Sensing (SNS)	.66	.55	.50	.55	.46	**.85**					
7. Coordinating (CRD)	.66	.55	.52	.64	.42	.74	**.85**				
8. Learning (LRN)	.60	.52	.45	.58	.45	.71	.72	**.91**			
9. Integrating (INT)	.51	.56	.52	.52	.46	.73	.69	.64	**.86**		
10. Reconfiguring (REC)	.57	.48	.47	.49	.42	.69	.69	.74	.65	**.88**	
11. Competitive performance (CP)	.50	.38	.37	.30	.33	.49	.47	.40	.38	.47	**.78**
Mean	4.80	5.05	4.97	5.37	4.05	5.01	5.07	5.08	4.87	4.86	4.71
Standard Deviation	1.23	1.45	1.56	1.39	1.09	1.18	1.13	1.25	1.24	1.22	1.26
VIF	2.13	1.83	2.52	2.26	-	2.73	2.53	2.68	2.58	2.48	-
Cronbach`s Alpha	.91	.88	.87	.92	.87	.88	.87	.93	.89	.90	.93
AVE	.69	.68	.67	.82	.80	.73	.72	.84	.75	.78	.62

Table 6. Assessment of convergent and discriminant validity of reflective constructs.

To operationalize the second-order constructs, a mixture of the repeated indicator approach and the use of latent variable scores in a two-stage approach was applied (Ringle et al., 2012). In the first stage, the repeated indicator approach was used to obtain latent variable scores for the first-order constructs, which in the second stage served as manifest variables in the measurement model of the higher-order construct. Path weights were estimated through the path weighting scheme of SmartPLS. In accordance with suggestions by Becker et al. (2012) we examined the weights of the first-order factors on the second-order factors. By assessing path weights and significance levels of first-order constructs it is revealed that each component is an important determinant of their assigned second-order construct. In addition, variance inflation factors (VIF) were below the threshold of 3.3 indicating low multicollinearity

5 Analysis

The structural model from the PLS analysis is summarized in Figure 1, where the explained variance of endogenous variables (R^2) and the standardized path coefficients (β) are depicted. The structural model is assessed by examining coefficient of determination (R^2) values, predictive relevance (Stone-Geisser Q^2), and effect size of path coefficients. To assess the degree to which IT-enabled dynamic capabilities mediate the impact of IT flexibility on competitive performance, two separate analyses were performed, (A) a direct model, and (B) a mediated moderation model. In the latter model the direct association was retained in order to observe if the relationship maintains its strength and significance or if it is weakened in the presence of the mediator construct (i.e. IT-enabled dynamic capabilities).

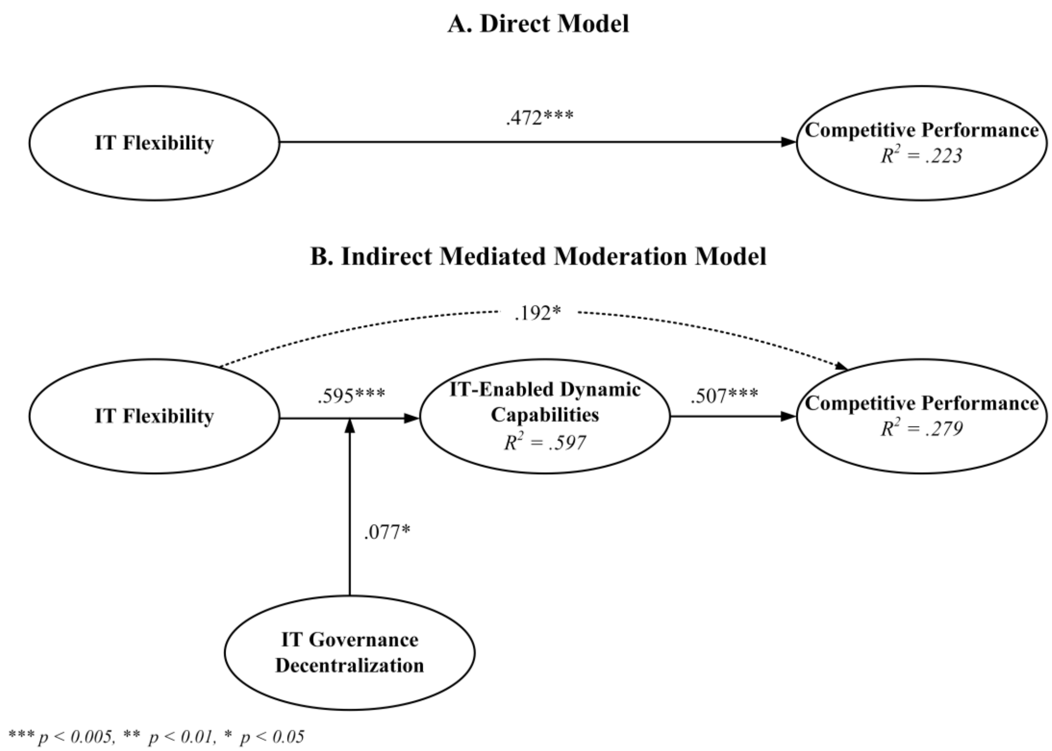

Figure 1. Estimated causal relationships of structural model.

To examine the causal paths of the structural model, a bootstrapping approach is employed using 5000 re-samples. Although the bootstrapping approach is limited by a fairly regular distribution, the means of constructs and items, as well as standard deviations demonstrate that this is not an issue in the present study. In Figure 1.A, the structural model demonstrates that IT flexibility has a positive and significant impact on competitive performance ($\beta = .472$ $t = 8.146$ $p < 0.005$), with the explained level of variance being 22.3% ($R^2 = .223$). At a second stage the mediator and moderator variables are included in the structural model. Figure 1.B shows that IT flexibility has a positive and significant impact on the formation of IT-enabled dynamic capabilities ($\beta = .595$ $t = 15.833$ $p < 0.005$), thus confirming H1. This relationship is found to be strengthened under the presence of IT governance decentralization, which demonstrates a positive and significant, yet lesser, mediating effect ($\beta = .077$ $t = 2.231$ $p < 0.05$). The combined impact of IT flexibility and IT governance decentralization explain 59.7% of variance ($R^2 = .597$) of IT-enabled dynamic capabilities. Finally, IT-enabled dynamic capabilities are found to have a positive and significant effect on competitive performance ($\beta = .507$ $t = 9.138$ $p < 0.005$), with an explained variance of 27.9% ($R^2 = .279$). The direct association of IT flexibility in model B is considerably lessened ($\beta = .192$ $t = 2.008$ $p < 0.05$)

which signifies for partial mediation. In addition to examining the R^2, the model is evaluated by looking at the Q^2 predictive relevance of exogenous constructs. This test is a measure of how well observed values are reproduced by the model and its parameter estimates, assessing the model`s predictive validity through sample re-use (Chin, 1998). The technique is a synthesis of cross-validation and function fitting, and examines individuals' constructs predictive relevance by omitting selected inner model relationships and computing changes in the criterion estimates (q^2) (Hair et al., 2012). Results of the blindfolding procedure demonstrate that IT-enabled dynamic capabilities ($Q^2 = 0.345$), and competitive performance ($Q^2 = 0.157$) have satisfactory predictive relevance since their values are greater than 0.

6 Discussion and Conclusions

The outcomes of this research contribute to IS literature through three key findings which raise several theoretical and managerial implications. First, rather than assuming that competitive performance gains are a result of IT resources or IT competencies *per se,* the perspective adopted in this study highlights the importance of strategically leveraging IT in core areas. Past studies have emphasized that such an approach is more viable since it is important to first understand the areas in which IT should be infused, and then work back to see what particular mix of IT resources and IT competencies can build such an IT-enabled capability (Kim et al., 2011). The areas described in this study constitute the dimensions of the IT-enabled dynamic capabilities construct, and are theoretically driven from the dynamic capabilities view.

Second, this study demonstrates that characteristics of a firms' IT architecture play an important role on how they are leveraged strategically. In effect, the indirect effect hypothesized, which places IT flexibility as a facilitator of IT-enabled dynamic capabilities, builds on theoretical underpinnings presented in numerous theories such as modular systems theory, and near decomposability theory (Simon, 1962), as well as on structural antecedents discussed in the dynamic capabilities view. The main argument in these theories and perspectives is that migrating to modular forms increases the possible combinations of outcomes, while simultaneously enhancing agility of operations. With regard to IT resources, our hypothesis posits that flexible IT architectures provide the necessary platform on which digital options can be enacted (Sambamurthy et al., 2003). The outcomes of the statistical analysis confirmed this hypothesis, which proves that flexible IT infrastructures are of business value, yet, their impact cannot be directly linked to competitive performance. Although IT flexibility has been extensively researched in past work, the mechanisms and capabilities through which its value is harnessed have remained underexplored. As such, this study adds to existing knowledge by underscoring the core areas which should be IT-infused.

Third, relating to modular forms, our study presents the impact that a decentralized IT governance scheme has in attaining competitive performance gains. Again, our hypothesis does not assume a direct relationship with competitive performance, but rather, that a decentralized IT governance scheme moderates the association between IT flexibility and IT-enabled dynamic capabilities. This outcome highlights the virtuous cycle of modularity that develops between IT architecture and IT governance structure, since a decentralized IT governance scheme is found to enhance the value of a flexible IT architecture. Therefore, by allocating decision rights to lines of business, firms are more prone in developing organizational capabilities that are enabled by IT in order to support or enact their operations. By strengthening the development of IT-enabled dynamic capabilities, respondents also hint that these IT-infused organizational capabilities are in better alignment with strategic objectives and goals under a decentralized IT governance structure. The fact that the path weight and significance of this moderation effect are rather weak can be attributed to the diversity of firms partaking in this study in terms of size-class. Micro and small firms usually do not have separate business units, but rather, coordinate all activities through a small number of employees. Thus, in such occasions it is not very meaningful to talk about decentralizing an IT governance.

Despite its contributions, the present study includes a number of limitations that future research should seek to address. First, as noted already, self-reported data are used to test hypotheses and propositions. Although considerable efforts are undertaken to ensure data quality, the potential of biases cannot be excluded. The perceptual nature of the data, in combination with the use of a single key informant could mean that there is bias, and that factual data do not coincide with respondents' perceptions. Although this study relies on top management respondents as key informants, sampling multiple respondents within a single firm would be useful to check for inter-rater validity and to improve internal validity. In addition, a slight positive skewness of data may be an indication of respondents overly assessing their firms' capabilities and performance. Second, the conceptualization and measurement of IT-enabled dynamic capabilities as a higher order construct comprising of five dimensions is derived by theoretical suggestions. Therefore, the underlying IT-based routines cannot be considered exhaustive, but merely representative of the core areas. Future, context specific work, can be directed towards novel areas of interest such as that of IT-enabled information generating capabilities; meaning the opportunities facilitated by unstructured data processing, and the knowledge that can be extracted through focused use of IT. Finally, a larger sample of firms would provide more robust results and enable cross-country comparisons as well as identification of differences between industries.

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