International Journal of Business, Economics and Management
2021 Vol. 8, No. 3, pp. 181-206.
ISSN(e): 2312-0916
ISSN(p): 2312-5772
DOI: 10.18488/journal.62.2021.83.181.206

IT GOVERNANCE AS DRIVERS OF DYNAMIC CAPABILITIES TO GAIN CORPORATE PERFORMANCE UNDER THE EFFECTS OF ENVIRONMENTAL DYNAMISM

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Article History
Received: 11 December 2020
Revised: 28 December 2020
Accepted: 14 January 2021
Published: 9 February 2021

Keywords
IT governance
Dynamic capability innovation capability
Dynamic capability operational capability
Corporate performance
Environmental dynamism
Heterogeneity.

JEL Classification:
M15: IT Management; O32: Management of Technological Innovation and R&D.

ABSTRACT

For researchers and practitioners, there is an important central question to answer, how information technology (IT) governance can help organizations survive and thrive in constantly changing business environments. To address this issue, this study examines the influence of IT governance on dynamic capabilities to sustain corporate performance under environmental dynamism. Tests of the proposed model were performed using survey data from 147 Brazilian firms to support the hypotheses. The results demonstrated that IT governance is a core enabler of dynamic capabilities innovation and operational capabilities for corporate performance gains. The heterogeneity tests also showed that the firm's orientation strategy of prospector and analyzer, under conditions of high dynamism environmental, increased the value of IT governance to enable innovation capability, while the impact of IT governance-enabled operational capabilities under low dynamism, amplified the firm's orientation strategy of defender and reactor. For practical application, this study indicated that managers should be knowledgeable about how IT governance capability plays a fundamental role to enable dynamic capabilities and generate economic payoffs.

Contribution/Originality: The original contribution of the work is illustrated of the relationship between IT governance practices, an approach that combined five IT capabilities, and dynamic capabilities (innovation and operational) to gain corporate performance under an uncertainty environment of dynamism, which has not been previously subject to large scale empirical testing.

1. INTRODUCTION

Firms that operate in turbulent environments face increasingly dynamic and digitized business settings, and thus have to implement governance practices (Åberg & Shen, 2020; Åberg & Torchia, 2020), mainly in the perspective of IT governance capability to transform the traditional business model and business processes to attend to market requirements in the digital world (Khalil & Belitski, 2020). The study, therefore, focuses on IT governance, where organizations have to use strategic IT assets, to better understand the market and customers need to develop dynamic capabilities (DC) to gain competitive performance that ensures the firm's survival (Aral & Weill, 2007; Mikalef & Pateli, 2017).

IT capabilities are identified as the organization's most valuable and strategic resource and firms have to remain competitive by enabling dynamic capabilities (Bharadwaj, 2000; Kim, Shin, Kim, & Lee, 2011; Li & Chan, 2019). According to Weill (2004); Weill and Ross (2004); Weill and Ross (2005), the effective IT governance to

manage and make better decisions require that firms develop IT capabilities, which comprise of IT strategy (ITS), IT architectures (ITA), IT infrastructure (ITI), IT business knowledge (ITK), and IT management (ITM). Therefore, IT capabilities can enable the rapid repositioning of firms' to respond to the demand changes and customers' requirements by rapidly restructuring their internal business processes through an adjustment to gain corporate performance (CP) (Lu & Ramamurthy, 2011; Mikalef & Pateli, 2017).

Although, other researchers have categorized the elements of IT governance into a generic model (Devos, Landeghem, & Deschoolmeester, 2012; Henriques, Pereira, Almeida, & Silva, 2020), practices (Héroux & Fortin, 2014; Jewer & McKay, 2012; Muammar & Nicho, 2019; Wilkin, 2012) and mechanisms (Levstek, Hovelja, & Pucihar, 2018; Mikalef, Pateli, & van de Wetering, 2020; Parry & Lind, 2016) in the firm, less attention has been devoted to IT governance capability as a second-order construct to ability in making better decisions to the use of IT, as defined by Weill (2004); Weill and Ross (2005), i.e., how IT governance integrates the first-order IT capabilities, to fit alignment of business strategy and IT, to draw and build firm ITA and ITI, and consequently support and incorporate novel business needs applications and IT management investments, to enable DC and CP gains.

Teece and colleagues (Teece, 2018; Teece, Peteraf, & Leih, 2016), postulated that the DC framework recognizes the importance of IT that enable firms to develop the ability to spur innovation and operational capabilities to enhance CP under turbulent and uncertain environments. Prior researches have shown that IT resources and capabilities play a fundamental role to promote a firm's DC and CP gains (Bharadwaj, 2000; Kim et al., 2011; Lu & Ramamurthy, 2011; Melville, Kraemer, & Gurbaxani, 2004; Tallon, Queiroz, Coltman, & Sharma, 2019; Yoshikuni & Albertin, 2017) through IT governance domains (Héroux & Fortin, 2014; Jewer & McKay, 2012; Li & Chan, 2019; Mikalef et al., 2020; Ping-Ju-Wu, Straub, & Liang, 2015). However, there is a lack of empirical evidence to support the impact of second-order IT governance through the first-order IT capabilities of ITS, ITA, ITI, ITBK, and ITM, enable dynamic capabilities (innovation and operational) thus promoting positive CP. Thus, the study aims to attempt to fill in the knowledge gaps and answer the following research questions:

RQ1. How does IT governance capabilities contribute to enable dynamic capabilities and enhance corporate performance under environmental dynamism in selected companies based in Brazil?

RQ2. Under what external and internal conditions can influence the relationships of the proposed model through heterogeneity?

Hence, this study contributes to answering the research questions, to enhancing the literature, in the following ways.

Firstly, the literature extends of IT governance through the operationalized IT governance construct with empirical research whose purpose is to detect how IT capabilities ability impact the effective IT governance domains of decision-making to enable dynamic capabilities in Brazilian firms, as recommended as an area of future research to understand its effects in a different context other than across Eastern and Western European countries, and to develop a novel classification of IT governance constructs related with management discipline, such as dynamic capabilities (Khalil & Belitski, 2020).

Secondly, there are many conceptual studies of dynamic capabilities by Teece and colleagues (Teece, 2007, 2018; Teece, 2009; Teece et al., 2016), and Eisenhardt and Martin (2000) that indicated a more ambitious research agenda to investigate, examine, analyze and validate the empirical research which details how firms gain competitive advantage, and consequently CP by enhancing DC. Moreover, Wang and Ahmed (2007) in a concept study of dynamic capabilities suggested that it is necessary to investigate antecedents and consequences of DC in an integrated framework related to firm strategy, development capabilities, and CP under market dynamism, as evidenced by the smaller number of key empirical studies that have identified the relationship.

Thirdly, past empirical research of heterogeneity test restricted their focus to a very limited set of criteria (Gelhard, von Delft, & Gudergan, 2016; Mikalef & Pateli, 2017; Wilden & Gudergan, 2015; Yoshikuni, Lucas, &

Albertin, 2019) and this study contributes to heterogeneity literature, answering the issue by Hair and Matthews and colleagues (Hair, Sarstedt, Matthews, & Ringle, 2016; Matthews, Sarstedt, Hair, & Ringle, 2016) that future studies should broaden the scope by considering information criteria, theory, and logic by FIMIX-PLS.

2. THEORY AND HYPOTHESIS DEVELOPMENT

2.1. Information Technology Governance

IT governance continues to be at a high level on most firm's (Caluwe & De Haes, 2019; Henriques et al., 2020). There are a lot of interesting definitions and also sources of information on IT Governance [see the IT Governance Institute (www.itgi.org)] that provides a series of toolkits, audit guidelines, and education offerings to focus on operational implementation and control of IT use; or firm capacity to formulate, implement, execute, and control IT strategy related with the board, executive management, and IT management (Chong & Duong, 2017; Muammar & Nicho, 2019; Parry & Lind, 2016; Weill & Ross, 2004).

Growing studies that focus on how IT governance can create IT value to influence DC and ultimately enhance CP (Khalil & Belitski, 2020). IT governance can be explained through firm IT mechanisms that enable organizations to be more flexible and agile by digital IT capabilities (Li & Chan, 2019) when reconfiguring business process to adapt, create, modify and implement products and services (Khalil & Belitski, 2020; Mikalef et al., 2020; Weill, 2004).

Most of the IT governance studies have utilized the IT domains and organizational resources to show the business value of IT. For example, Henriques and colleagues (Henriques et al., 2020) investigated the conceptual study of IT governance enablers by the COBIT framework to ensure that an organization's IT sustains and extends its strategies and objectives. Pathak and colleagues (Pathak, Krishnaswamy, & Sharma, 2019) conducted a case study to investigate how IT governance employed by IT practices enables an organization to achieve a business value of IT which is higher than the industry standard, from both strategical and operational perspectives. Abraham, Schneider, and vom Brocke (2019) conducted a conceptual study to investigate the data governance programs which focused on data decision domains such as; data quality, data security, data architecture, data lifecycle, metadata, and data storage and infrastructure. Levstek et al. (2018) investigated, by extensive literature review, how IT governance mechanisms, standards, frameworks, and best practices become an accepted part of strategic and operational governance processes towards an adaptive IT Governance Model. Silva and Moraes (2011) investigated how IT governance domains [IT principles, architecture, infrastructure, investments and prioritization, and business applications (Weill, 2004; Weill & Ross, 2005)] and IT use drives can contribute to the job description structure and responsibilities organization for better firm performance. Köbler, Fähling, Krcmar, and Leimeister (2010) inventoried IT governance structures in German hospitals based on IT Governance domains by Weill and colleagues (Weill & Woodham, 2002; Weill, 2004; Weill & Ross, 2005) and compared that IT decision-makers differ with firm-size hospitals concerning strategic aspects. Huang, Zmud, and Price (2010) conducted a case study in three small-medium-sized firms in the United States of America investigating the effectiveness of IT governance practices through steering committees and communication policies that were associated with success in using IT. Xue, Liang, and Boulton (2008) investigated that the variation of IT governance archetypes, by Weill and Ross (2004) has different stages that were affected by contextual factors (Characteristics of IT investment, external environment, and internal context) that contribute to the different success of IT use. Many conceptual and qualitative studies have demonstrated that IT governance domains contribute to better use of IT and consequentially can create success in corporate performance.

Many empirical survey studies have examined the impact of IT governance, by the lens of the resource-based view and dynamic capability view to enable better outcomes or firm performances. For example, a recent study on IT governance (Khalil & Belitski, 2020) examined through the multivariate regression analysis of the cross-section of how IT governance factors influenced the changes in sales and productivity through the digital capabilities and

skills used strategically. Another recent study (Mikalef et al., 2020) showed IT governance decentralization influence the impact of IT-enabled dynamic capabilities on competitive performance through IT flexibility. Héroux and Fortin (2018) examined that IT governance (strategic, management, or operational domains) and IT intensity, as dynamic capabilities, support organizations to react promptly to innovate. Ping-Ju-Wu and colleagues (Ping-Ju-Wu et al., 2015) examined the effects of strategic alignment mediation in the relationship between IT governance mechanisms on organizational performance in the context of Taiwanese companies. Lunardi, Becker, Maçada, and Dolci (2014) analyzed that Brazilian companies which have adopted formal IT governance mechanisms [such, as COBIT, ITIL, SOX, internal solution, BS7799/ISO17799, PMI, SLA/SLM, IT Steering Committee Pos, BSC / IT BSC, all large firm-sized listed on the São Paulo Stock Exchange (BOVESPA)], have a positive correlation with financial performance. Jewer and McKay (2012) examined the antecedents and consequences of board IT governance and identified that it has a positive impact on the contribution of IT to firm performance. Dong (2012) analyzed in the Chinese firms, that the CRM systems integrated customer-oriented business processes, IT governance structures, and mechanisms (Decision execution mechanisms) can influence firm performance.

Even though, the majority of these studies have investigated the link between IT governance domains and performance without identifying the enablers of dynamic capability innovation and operational capabilities, mainly under an uncertain environment of dynamism through IT governance capability ability in making better decisions to the use of IT, as defined by Weill (2004); Weill and Ross (2005). Hence, this study examines how IT governance enables both business strategy and IT unit to support business/IT alignment to the creation of business value from IT-enabled business investments through dynamic capabilities (Caluwe & De Haes, 2019; Khalil & Belitski, 2020).

2.2 Dynamic Capabilities Enabled through IT Governance

The contemporary competition, firms aim to implement IT governance, faced with an increasingly dynamic and digitized business environment, to transform organizational capabilities to enhance firm performance (Khalil & Belitski, 2020; Pathak et al., 2019). The Dynamic Capabilities View (DCV) has emerged in the strategic management literature (Schilke, 2014), to enable firms to integrate, build, and reconfigure their resources and competencies in the face of changing environmental factors (Teece, 2018; Teece, Pisano, & Shuen, 1997). Recent studies demonstrated that IT governance can enable DCV to allow firms to be more flexible and agile when using IT resources and organizational capabilities (Pathak et al., 2019) to reconfigure, adapt, modify and implement new processes and products/services to gain firm performance (Héroux & Fortin, 2018; Mikalef et al., 2020).

This study builds on the definition of IT governance, it is important to further explain the role of each of the IT governance-enabled capabilities (Khalil & Belitski, 2020; Weill & Ross, 2004). Therefore, this study adopted IT governance related to dynamic capabilities concept (Teece, 2018) , developed by IT units, that enable organizations to appropriate value from five key IT capabilities: IT strategy (ITS), IT architecture (ITA), IT infrastructure (ITI), IT business knowledge (ITBK), and IT management (ITM) to enhance innovation and operational capabilities and corporate performance (CP).

According to Aral and Weill (2007) firms need to align business strategy and ITS, it occurs when IT principles capture the essence of a firm's future direction and IT fits to support the strategic goals. Hence, effective IT governance requires capabilities to align decision making among business and ITS (Weill, 2004) to implement DC and respond quickly to changes by implementing efficient IT governance capability (Coltman, Tallon, Sharma, & Queiroz, 2015; Gerow, Grover, Thatcher, & Roth, 2014; Khalil & Belitski, 2020). ITS is modeled to extent of IT use in support of business model and activities (Queiroz, 2017; Yayla & Hu, 2012) that focus on backing the business strategy, such as proactiveness, analysis, defensiveness, or reactiveness (Chan & Reich, 2007; Tallon & Pinsonneault, 2011; Tallon et al., 2019). Previous studies demonstrated that ITS enables direct and (or) indirect organizational capabilities to enhance firm performance (Queiroz, 2017; Sabherwal & Chan, 2001; Yayla & Hu, 2012; Yoshikuni, Favaretto, Albertin, & Meirelles, 2018).

IT architecture provides an integrated set of technical (software applications and subsystems) choices to guide the firm to support business needs (Huang, Zmud, & Price, 2009; Köbler et al., 2010; Xue et al., 2008). Flexible ITA can promote increased levels of strategic alignment through a set of policies and rules that govern the use of IT and drive a migration path under circumstances that require agile and swift responses (Kim et al., 2011; Tallon & Pinsonneault, 2011). Hence, the IT architecture-enabled dynamic capabilities when the core firm's IT resources are sharable and reusable, such as the use of data, design of applications, and change management processes necessary to exploit the new technologies to active organizational capabilities (Mikalef et al., 2020; Tiwana & Konsynski, 2010).

IT infrastructure describes the approach to building the IT foundation, and its capability is a critical factor that promotes the speed with which new business initiatives can be implemented (Weill, 2004; Weill & Ross, 2005; Yoshikuni & Albertin, 2017). ITI related to the IT resources (systems and their components, network and telecommunication facilities, and applications) that enable organizational capabilities to collaborate, integrate, and share in performing functional routines (Aral & Weill, 2007; Kim et al., 2011) to lead the market and capabilities for meeting agile demand to enhance CP (Mikalef et al., 2020; Yoshikuni & Albertin, 2020). Benitez and colleagues (Benitez, Castillo, Llorens, & Braojos, 2018) confirmed that a higher social media capability degree influences the relationship between ITI and ambidexterity knowledge (to explore new knowledge and exploit existing/new knowledge) to create innovation. Therefore, IT-related ordinary capabilities are influenced by ITI into the functionality, integration, and flexibility of IT resources which enable DC to promote competitive advantage (Li & Chan, 2019).

IT business knowledge is related to the organizational expertise (IT staff and business executives) to the understanding of an organization's challenges to be able to formulate adequate IT solutions according to business requirements (Kim et al., 2011; Weill & Ross, 2004). Hence, ITBK can be considered a key source of strategic advantage and organizational capabilities, because it creates a systematic mix of individual, team, and organizational experience by skills, expertise, which allow firms to identify business application needs by know-how derived from processed information (Henriques et al., 2020; Li & Chan, 2019) . According to Bharadwaj (2000) and Kim et al. (2011) ITBK management related to the technical expertise held by IT staff and managerial IT skills can ability firm staff to deploy, coordinate, and innovate with IT resources and practices to enhance organizational capabilities and firm performance.

IT management is manifested by the collection of IT activities (structured in formal and informal practices) of planning, investment decision-making, coordination, and control (Weill & Ross, 2005; Weill & Ross, 2004). According to Li and Chan (2019) , dynamic ITM capability is related to the IT ability to design and execute changes to work processes that manage IT resources and practices in a manner aligned, such as IT investment, with the firm's goals and priorities. ITM capability is the IT staff's ability to manage resources to transform them into business value at an organization to achieve the business strategy (Kim et al., 2011; Turedi, 2020; Xue et al., 2008; Yoshikuni & Albertin, 2020). Therefore, ITM capability enables IT units to prioritize resource to regularly update their service portfolios to support new business processes (Yeow, Soh, & Hansen, 2018), such as, for example, rapidly improve product/service offerings in response to shifting customer needs (Lu & Ramamurthy, 2011), and rapidly reconfigure internal business processes that require change by market and other stimuli (Mikalef & Pateli, 2017).

This study referred to IT-governance-related ordinary capabilities as the capabilities by IT unit manage, deploys, and support IT resources, as mentioned by Winter (2003). Hence, as stated by DCV (Faccin, Balestrin, Volkmer Martins, & Bitencourt, 2019; Helfat & Raubitschek, 2018; Helfat & Winter, 2011; Teece et al., 1997) this study adopted the hierarchical structure in which lower-order dynamic IT governance capability lead to higher-order organizational capabilities. Therefore, IT governance capability is a first-order dynamic capability that IT units (by firms resource of IT physical, human, and other organizational) develop to extend, modify, or create IT-

related ordinary capabilities, second-order dynamic capabilities, such as business processes of sensing, seizing, and reconfiguring capabilities to enhance outcomes performances (Daniel, Ward, & Franken, 2014; Li & Chan, 2019; Mikalef & Pateli, 2017).

As stated, IT governance capability is often achieved by setting IT strategy, IT architecture, IT infrastructure, IT business knowledge, and IT management that allow a strong flavor of innovation and market responsiveness. IT governance is designing and implementing respective practices and arrangements to enable the multifaceted (Muammar & Nicho, 2019) and integrated approach to related to old systems and with open source and latest technologies that support operational adjustment and create innovation (Pathak et al., 2019). A recent study of IT governance (Khalil & Belitski, 2020) demonstrated evidence points towards the importance of developing IT governance mechanisms in enabling firm innovation and sales in European SMEs by coordination and administering operations processes and coordination of data on products, partners, customers. Therefore, adopting the DCV approach (Teece, 2018), as second-order IT governance capability, via the combination of IT capabilities (Li & Chan, 2019), is likely to facilitate dynamic capabilities such as innovation and operational capabilities and lead to higher firm performance. Thus, this study hypothesized that:

H1. IT governance capability has a positive influence on dynamic capability innovation capability.

H2. IT governance capability has a positive influence on dynamic capability operational capability.

2.3. The Mediating Role of Dynamic Capability Operational Capability

Dynamic capabilities (DC) are related to a firm's ability to sense and then seize new opportunities, and to reconfigure business process and business model through strategic knowledge assets, competencies, and complementary resources to achieve a sustained competitive advantage (Augier & Teece, 2009; Helfat & Raubitschek, 2018; Teece et al., 1997). DC relate to the organization's ability to respond to changing environmental conditions by modifying its distinctive and co-specialized resources (Teece, 2018).

In this study, dynamic capability innovation capability (DCIC) is conceived as the ability of an organization to reconfigure its operational capabilities and deploy new capabilities to attend to changing business requirements by customers (Breznik & Hisrich, 2014; Teece & Pisano, 1994; Teece et al., 1997; Vagnani, Gatti, & Proietti, 2019). Hence, DCIC is the capacity to scan, sense, and detects opportunities and threats, identifying and exploring the external environment; seizing opportunities by creating new products and services, selecting and or adapting architectures and business models; transforming firm processes (Teece, 2009).

To attend the DCIC organizations' need to develop evolutionary fitness refers to the dynamic capabilities that facilitate a firm to compete by creating, extending, or modifying its resources by IT capabilities (Mikalef & Pateli, 2017). Hence, firms need to develop the DCIC to enable them to compete and respond to changes in the external environment, prioritizing business strategy, and market requirements (Wilden & Gudergan, 2015). Operational capability can be enabled by IT capabilities that improve the speed, effectiveness, and efficiency with which the firm operates (Drnevich & Croson, 2013). In this study of dynamic capability operational capability (DCOC) is the ability to promote operational adjustment relate to internal business processes to rapidly adapt triggered through the market and other stimuli (Aslam, Blome, Roscoe, & Azhar, 2020; Lu & Ramamurthy, 2011).

DCOC enables greater process reach and rapid sequencing and business activities coordination along the generic value chain through faster adaptation of internal business processes, operational adjustment agility facilitated through IT capabilities (Mikalef & Pateli, 2017). According to Aslam, Blome, Roscoe, and Azhar (2018) a firm's responsiveness by integrating sensitivity to market changes is enabled by the operational capabilities to respond to these changes in a flexible and timely manner, increasing responsiveness through rapid adaptation to customers demand. The IT governance by IT architecture and infrastructure offer digital processes options, and the IT knowledge management that they create, facilitate the development of DCIC (Khalil & Belitski, 2020) by leveraging the inexpensive interconnectivity of DCOC by virtual markets and gaining faster and more informed

decision making (Mikalef & Pateli, 2017). Therefore, it can be argued that dynamic capability operational capability provides the agile and efficiency gains of dynamic capability innovation capability through IT governance capabilities. Thus, it proposes the following hypothesis:

H3: Dynamic capability operational capability mediates the relationship between IT governance capability and dynamic capability innovation capability.

2.4. Effects of Dynamic Capabilities on Corporate Performance

This study adopted the corporate performance (CP) across multiple organizational dimensions (Mithas, Ramasubbu, & Sambamurthy, 2011; Mostaghel, Oghazi, Beheshti, & Hultman, 2015; Reefke & Trocchi, 2013; Sen, Bingol, & Vayvay, 2017; Yoshikuni & Albertin, 2018). Balanced Scorecard [BSC, Kaplan and Norton (2008)] was considered by many researchers as an effective tool for measuring CP based on financial success, market satisfaction, internal business process efficiency, and organizational learning.

The dynamic capabilities (DC) that enable business enterprises to underpin firm-level sensing, seizing, and reconfiguring capacities are difficult to develop and deploy to support superior, long-run CP (Helfat & Raubitschek, 2018; Teece, 2007). With enhanced DCIC, organizations can sense opportunities in their target markets and may prepare for the requirements or develop new resources and competencies to harness these opportunities (Breznik & Hisrich, 2014; López-Nicolás & Meroño-Cerdán, 2011). Hence, firms develop DCIC over time that enables organizations to constantly search, scan, explore and implement new opportunities to address the rapidly changing environment and to match market changes (Teece, 2018; Teece et al., 2016). The DCOC allows firms a timely response to changing customer requirements through developing new partnerships, improving flexibility of operational routines, reducing costs, and consequently cultivate better relationships with their customers (Mikalef & Pateli, 2017). In effect, DCOC enables organizations to capitalize on changes in their market by transforming value propositions (new or enhancing) and improving internal operation processes to sustain the market changing and demand (Aslam et al., 2018; Lu & Ramamurthy, 2011).

Therefore, firms that improve dynamic capabilities can manage to expand the competitive actions repertoire, and then they will be more likely to prosper to gain corporate performance. So, both types of dynamic capabilities influence to enhance corporate performance and it is hypothesized that:

H4. Dynamic capability innovation capability is positively associated with corporate performance.

H5. Dynamic capability operational capability is positively associated with corporate performance.

2.5. The Moderation Effects of Environmental Dynamism

The value of dynamic capabilities (DC) can be more discernible under conditions of high environmental uncertainty by unpredictable events, face fast-paced change, and unexpected discontinuities (Teece, 2007; Teece et al., 1997). As stated that organizational capabilities to rapidly revamp operational and innovation capabilities which depend on the level of dynamic capabilities (Lu & Ramamurthy, 2011; Teece, 2018). In this view, the external environment factors work with a trigger in putting dynamic capabilities to action, and their effect is realized through firms' ability to enhance their organizational capabilities (Bowman & Ambrosini, 2009).

This study adopted environmental dynamism as the rate and unpredictability of environmental changes in terms of frequency, customer preferences which influence firms to develop ability by organizational capabilities to address these challenges (Mikalef et al., 2020; Newkirk & Lederer, 2010).

Uncertainty environmental conditions are suggested to be significant effects of a firm's internal structuring to IT governance capability and the derived business value (Khalil & Belitski, 2020) . Competitive pressures stemming from the dynamic environment are in favor of IT governance to enable DC through IT capabilities, such as IT strategy (Chen, Mocker, Preston, & Teubner, 2010; Coltman et al., 2015; Gerow et al., 2014; Kohli & Grover, 2008; Yoshikuni et al., 2018), IT architecture (Batra, 2020; Kim et al., 2011; Mikalef et al., 2020; Pavlou & El Sawy, 2010;

Queiroz, Tallon, Sharma, & Coltman, 2018), IT infrastructure (Kim et al., 2011; Lu & Ramamurthy, 2011; Mikalef et al., 2020; Pavlou & El Sawy, 2010; Queiroz et al., 2018), IT business knowledge and IT management (Aral & Weill, 2007; Kim et al., 2011; Li & Chan, 2019; Ngai, Chau, & Chan, 2011; Tallon et al., 2019) to enhance corporate performance (Khalil & Belitski, 2020; Weill & Ross, 2005).

The value of DC is assumed to address uncertain environments of high dynamism, but it is also suggested that dynamic capabilities are useful in a low degree of dynamism, in stable environments. Empirical studies have demonstrated different value-adding of DC under uncertain conditions, such as in a stable setting (Yoshikuni & Albertin, 2018), moderate (Pavlou & El Sawy, 2010), in a high degree of dynamism (Wilhelm, Schlömer, & Maurer, 2015). The current research provides different results on the influence of environmental dynamism on the relationship between IT capabilities in favor of IT governance on dynamic capabilities. Therefore, this study is hypothesized that:

H6a: The environmental dynamism influences the relationship between IT governance and dynamic capability innovation capability.

H6b: The environmental dynamism influences the relationship between IT governance and dynamic capability operational capability.

There is abundant literature that has supported that the turbulence and uncertainty environment affects firm performance (Barbero, Ramos, & Chiang, 2017; Chaudhary & Batra, 2018; Schilke, 2014; Wang & Li, 2008; Wilden & Gudergan, 2015). In line with previous studies that have demonstrated that environmental factors influence the relationship between innovation and operational capabilities on corporate performance (Aslam et al., 2018; Lu & Ramamurthy, 2011; Mikalef & Pateli, 2017). This study hypothesis that:

H7a: The environmental dynamism influences the relationship between dynamic capability innovation capability on corporate performance.

H7b: The environmental dynamism influences the relationship between dynamic capability operational capability on corporate performance.

2.6. Heterogeneous Influence of IT Governance and Dynamic Capabilities

Previous studies have demonstrated that business processes likely develop and function differently across firms, due to the predisposition of the firm to respond particularly to the influence of external and internal elements, such as path dependencies (Gelhard et al., 2016; Mikalef & Pateli, 2017; Wilden & Gudergan, 2015; Yoshikuni et al., 2019). The influence of antecedents and consequences of dynamic capabilities also varies with environmental conditions (Eisenhardt & Martin, 2000; Schilke, 2014) and IT governance capability (Khalil & Belitski, 2020; Mikalef et al., 2020).

Thus, and in drawing on Hair and Matthews and colleagues (Hair et al., 2016; Matthews et al., 2016), there is likely heterogeneity in how IT governance influences dynamic capabilities to enhance corporate performance, and environmental dynamism, competitive strategy, and control variables (size, age, and sector) likely affects these relationships. This study adopted the definition of competitive strategy by the classification of the firm's orientation strategy (Anwar & Hasnu, 2016; Miles, Snow, Meyer, & Coleman, 1978; Yoshikuni & Albertin, 2018): Prospector firms monitor market trends to be the first entrant in a new market or the first developer of a new proposal value; Defender firms protect their status in the current markets and seek market; Analyzer firms primarily seek to minimize risk and maximize profit opportunities, developing a balance between Prospector and Defender; and last Reactor firms tend to be inconsistent in their adaptive patterns and they respond to changes in competitive circumstances only when forced.

H8: The presence of heterogeneity influences the effects in the relationship between IT governance, dynamic capabilities, and corporate performance.

The literature review has presented important concepts related to KSP, ISS, DCIC, and FP. For the proposed model see Figure 1.

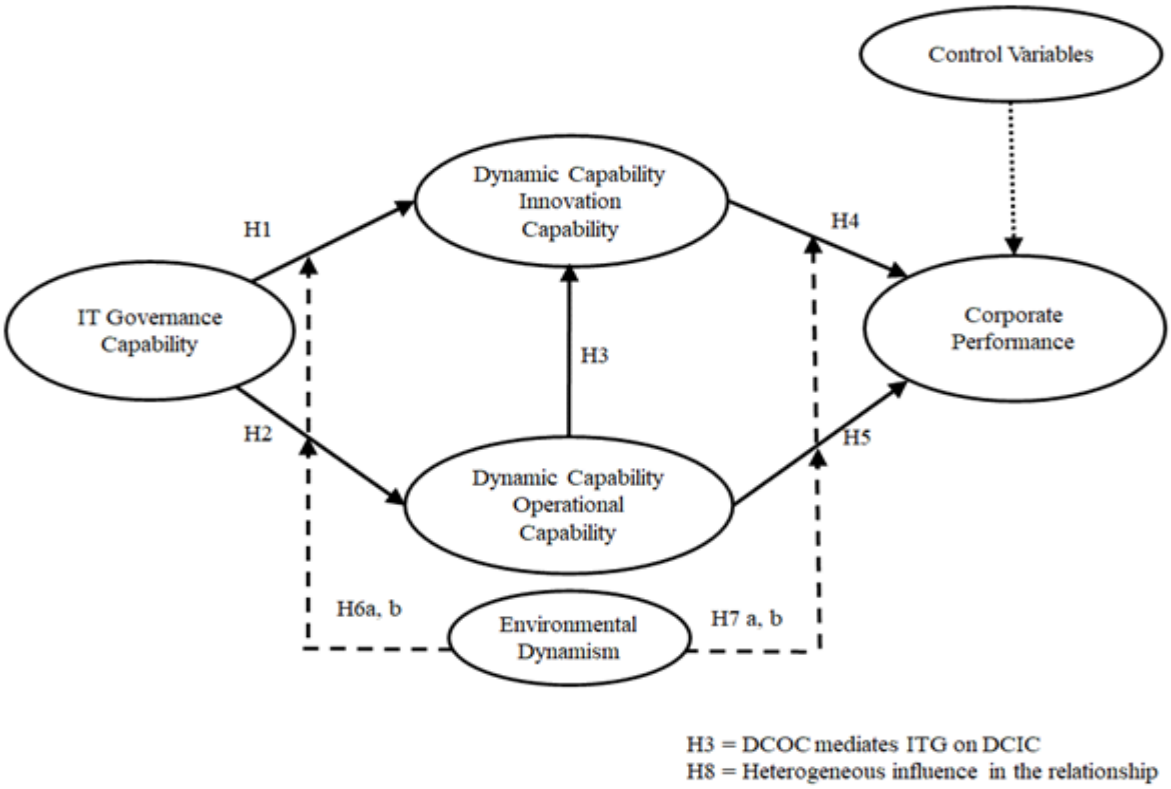

Figure-1. Research Model.

3. RESEARCH METHODOLOGY

3.1. Scale

The study adopted constructs that have been operationalized in the current literature, and also conducted intensive reviews of relevant studies and pre-tests with nine academics and five senior executives for newly developed scales to enhance the face validity and discriminant validity of the measures, as recommended by Jarvis, Mackenzie, Podsakoff, Giliatt, and Mee (2003) and Hair, Hult, Ringle, and Sarstedt (2017). The IT governance was defined as the degree of decomposition of IT capabilities to the ability to make better decisions of IT use, as defined by Weill (2004); Weill and Ross (2005). IT governance capability is developed as a type II second-order construct (first-order reflective and second-order formative), with first-order IT capabilities dimensions being, IT strategy (Chen et al., 2010; Coltman et al., 2015; Gerow et al., 2014; Yayla & Hu, 2012), IT architecture (Köbler et al., 2010; Weill & Ross, 2005), IT infrastructure (Aral & Weill, 2007; Li & Chan, 2019), IT business knowledge, and IT management (Kim et al., 2011; Li & Chan, 2019). It was built on the dimensions proposed through Weill and Ross (2004) and developed combined measures for them based on current research. This choice to build the second-order construct provided more richness to IT governance concepts to assess how IT capabilities ability make better decision to use IT to enable dynamic capabilities and attain corporate performance.

Dynamic capabilities innovation capabilities was adopted by a seminal study from Venkatraman (1989) and complemented it by Teece et al. (2016); dynamic capabilities operational capability was adopted from Lu and Ramamurthy (2011) and Mikalef and Pateli (2017); corporate performance was adopted by a seminal study from Kaplan and Norton (2008) and operationalized from Yoshikuni and Albertin (2018); uncertainty environment of dynamism was adopted from the study of Newkirk and Lederer (2010) and Mikalef et al. (2020); competitive strategy, a firm's orientation strategy, was adopted from the study of Miles et al. (1978) and Yoshikuni and Albertin (2018); and control variables were included by firm size, firm age, and firm sector, as recommended by previous IS studies (Kohli & Grover, 2008; Melville et al., 2004).

All construct were operationalized and respondents were asked to evaluate on a 7-point Likert scale (from 1 = "strongly disagree" to 7="strongly agree). The instrument validation was performed by pretest with a sample of 18 companies, selected by the authors, as recommended through Malhotra (2010). The questionnaire was adjusted to make more friendliness, clarity, comprehensiveness with items, and adjust of instrument labels. In Appendix A is available the questionnaire.

3.2. Sample

The study adopted the convenience sampling data collection, and the author contacted the organizations, in line with other empirical IS studies. The respondents belong to a wide selection of organizations from a myriad of business sectors, as indicated by Sekaran (2016) and Etikan, Musa, and Alkassim (2016). The research respondents included general managers and senior business executives from the IT unit involved in their respective company's management processes of IT governance.

The final sample size 147 satisfied the requirement for partial least squares path modeling (PLS-PM) (Henseler, Hubona, & Ash, 2016). The literature on PLS-PM mandates that a sample is no less than 10 times the number of structural paths that predict a given reflective construct (Hair et al., 2017) that defined 50 cases.

3.3. Statistical Technique

It was adopted to analyze the data using partial least squares structural equation modeling [PLS-SEM by the SmartPLS software package (Ringle, Wende, & Becker, 2015)]. Because PLS-SEM allows the assumptions on multivariate normality, combine the use of both reflective and formative constructs, to analyze complex models in a small sample, examining the chain of effects, and it uses as a predictive tool for theory building (Henseler et al., 2016; Ringle, Sarstedt, & Straub, 2012). Furthermore, PLS-SEM allows examining indirect and total effects, reducing error associated with the model by assessing the relationships between multi-item constructs (Henseler et al., 2016).

Analysis of the sample showed 35% of the sample consisted of senior/executive managers, and 65% consisted of middle/first-line managers with the power to make decisions within their respective companies. A summary of the characteristics of the sample demonstrated by firms' sector in the commerce (8%), financial (23%), manufacturing (19%), and services (50%). The firm-size is characterized by employees' numbers from small (9%, until 49), medium (21%, between 50 and 499), and large (above 500). The firm-age is characterized by (years of operation) 9% of young (until 9.9), 21% of medium (among 50 and 19.9), and 70% maturity (above 20). Thus, large firm-size, maturity firm-age, and service organizations were more heavily represented in our sample than firms of other characteristics.

3.3. Common Method Bias

The study was controlled by the common method bias CMB in the research design phase by using priori approaches through Schwarz, Rizzuto, Carraher-Wolverton, Roldán, and Barrera-Barrera (2017) such as: choosing respondents with the ability to answer the questionnaire, items constructed in clear and concise language, counter balancing the order of questions, respondents remained anonymous and data collected was analyzed for research purposes solely at an aggregate level; and applied technical remedies as suggested by MacKenzie and Podsakoff (2012) and Fuller, Simmering, Atinc, Atinc, and Babin (2016).

To detect and control, CMB was applied to the statistical techniques as recommended by Chin, Thatcher, Wright, and Steel (2013). The measured latent marker variable (MLMV) technique was used in the constructs of DCIC, DCOC, and CP, through four formative indicators used for MLMV. It was designed to have the lowest possible correlation with the other constructs under investigation were used. The MLMV was adapted through items by Yoshikuni and Albertin (2018). By comparing the difference in all variance explanation (R^2) with and without additional marker variable, and the model with MLMV variables revealed a more fitting sight than the original one (less than 1%), see Table 1. Thus, this suggests that CMB is not a severe concern in this study.

4 RESULTS

4.1. Measurement Model

The study examined the first-order reflective latent variables that were assessed in terms of reliability at construct level by composite reliability (CR) and Cronbach's alpha (α) indicators and all values being above the threshold of 0.70, suggesting acceptable construct reliability (Fornell & Larcker, 1981). It was assessed the

indicator reliability through construct-to-item loadings, and all items had loadings above 0.69, thereby indicating discriminant validity (Hair et al., 2017) Appendix B. Convergent validity was assessed, and all average variance extracted (AVE) for each construct was above the threshold value of 0.50 and each construct's AVE square root was greater than its highest correlation with any other construct (Fornell-Larcker criterion), see Table 1. The discriminant validity was established by; (a) examining if each constructs AVE square root was greater than its higher correlation with any other construct (Fornell-Larcker criterion), (b) whether each indicator's outer loadings on its assigned construct was greater than its cross-loadings with other constructs, and (c) the heterotrait-monotrait ratio (HTMT) was examined and all correlation between constructs were perfectly measured, the highest HTMT was 0.88, which the lower limit that is 1.0 (Henseler, Ringle, & Sarstedt, 2015). Thus, the first-order reflective measures were reliable, and the items were appropriate indicators for the respective latent variables Table 1 and Appendix B.

Table-1. Assessment of reliability, convergent and discriminant validity of reflective constructs.

Constructs	1	2	3	4	5	6	7	8	9	10	11	12
1-ITS	0,859											
2-ITA	0,610	0,870										
3-ITI	0,648	0,750	0,797									
4-ITBK	0,646	0,619	0,748	0,838								
5-ITM	0,627	0,576	0,721	0,744	0,888							
6-DCIC	0,518	0,515	0,552	0,544	0,501	0,816						
7-DCOC	0,490	0,587	0,544	0,563	0,478	0,608	0,828					
8-FP	0,451	0,411	0,475	0,478	0,418	0,484	0,483	0,875				
9-MP	0,461	0,398	0,540	0,488	0,526	0,483	0,435	0,649	0,809			
10-IPP	0,581	0,576	0,599	0,576	0,497	0,603	0,607	0,646	0,66	0,821		
11-LGP	0,436	0,417	0,550	0,552	0,589	0,556	0,491	0,528	0,587	0,512	0,844	
12-DYN	0,347	0,359	0,308	0,341	0,377	0,428	0,401	0,265	0,254	0,351	0,250	0,783
CA	0,881	0,935	0,808	0,859	0,867	0,869	0,848	0,897	0,733	0,754	0,866	0,791
Rho_A	0,888	0,935	0,819	0,867	0,872	0,872	0,854	0,900	0,749	0,757	0,897	0,810
CR	0,918	0,949	0,874	0,904	0,918	0,908	0,897	0,929	0,849	0,860	0,908	0,864
AVE	0,738	0,756	0,635	0,701	0,789	0,666	0,686	0,766	0,654	0,674	0,712	0,614

Note: ITS:IT Strategy; ITA:IT Architecture; ITI:IT Infrastructure; ITBK: IT Business Knowledge; ITM: IT Management; DCIC: Dynamic Capability Innovation Capability; DCOC: Dynamic Capability Operational Capability; FP: Financial Performance; MP: Market Performance; IPP: Internal Process Performance; LGP: Learning and Growing Performance; CA - Cronbach's Alpha; AVE - Average Variance Extracted, CR - Composite Reliability.

The study operationalized the second-order construct (reflective-formative type), the repeating indicator approach was used to obtain latent variable scores for the first-order constructs, that in the second stage served as manifest variables in the measurement model of the higher-order construct. Also, it was examined the variance inflation factors (VIF) which were all below the threshold of 3.6, suggesting low multicollinearity (Hair et al., 2017) Table 2.

Table-2. Multicollinearity analysis and path weights of formative-reflective second-order measurements

Construct	Dimension	Weight	t value	p-value	VIF
IT Governance	ITS	0,214	13,853	0,000	2,090
	ITA	0,358	21,015	0,000	2,436
	ITI	0,204	21,289	0,000	3,626
	ITBK	0,218	19,085	0,000	2,969
	ITM	0,172	13,103	0,000	2,698

4.2. Structural Model Assessment

The structural model from the PLS analysis is summarized in Table 3: the effect size of path coefficients (f^2), path coefficients (β), coefficient of determination (R^2), and CMB. The significance of estimates (t-statistics) is obtained by performing a bootstrap analysis with 5000 resamples.

Table-3. Structural model assessment.

Variables relationship	f^2 effect size	Path coefficient	Standard Deviation	*t* value	*p* value	R^2	R^2 with MLMV
ITG -> DCIC	0,080	0,283	0,080	3,547	0,000	0,494	0,506
DCOC -> DCIC	0,144	0,361	0,085	4,227	0,000		
DYN*ITG->DCIC	0,032	-0,142	0,068	2,073	0,038		
ITG -> DCOC	0,473	0,584	0,067	8,749	0,000	0,430	0,451
DYN*ITG->DCOC	0,046	0,069	0,047	1,473	0,141		
DCIC -> CP	0,146	0,358	0,086	4,157	0,000	0,531	0,559
DCOC -> CP	0,161	0,362	0,079	4,608	0,000		
DYN*DCIC->CP	0,004	-0,053	0,078	0,683	0,495		
DYN*DCOC->CP	0,036	0,159	0,074	2,137	0,033		
Sector -> CP	0,015	-0,087	0,063	1,385	0,166		
Size -> CP	0,049	0,167	0,072	2,311	0,021		

Table 3 shows that the direct effect among all latent variables is statistically significant (p-value < 0.001) and supports hypotheses H1, H2, H4, and H5. The control variables were assessed, and the sector was not statistically significant (p-value > 0.05), but the firm size demonstrated influence on the CP (p-value < 0.001). The effect size f^2 demonstrated all direct values are above the thresholds of either 0.08 or 0.35 in the direct effects, it can conclude that they have moderate to high effect sizes.

4.3. Mediation Analysis

The study performed the mediation analysis to examine if the indirect effects involved in the relationship between IT governance, DCOC, and DCIC were significant by following the Preacher and Hayes (2008). The mediation was assessed by (1) it was checked if the direct effect is significant without the mediator presence of DCOC in the model, and (2) the significance of indirect effect and associated p-value < 0.05 are then examined using the path coefficients when the mediators are included in the model. Thus, the significance of indirect effect was established, and the magnitude of mediation was measured by variance account for (VAF), which demonstrated partial mediation of DCOC (VAF=43%) in the relationship between ITG and DCIC, see Table 4. Hence, hypotheses H3 was supported.

Table-4. Mediation analysis.

Relationship	Direct Effect	Indirect Effect	t value	p value	Total Effect	VAF
ITG -> DCIC	0,283					
ITG -> DCOC	0,584					
DCOC -> DCIC	0,361					
ITG -> DCOC -> DCIC		0,211	3,854	0,000	0,494	43%

4.4. Environmental Dynamism Moderation

The environmental dynamism moderation was checked, and moderation was no present in the relationship between IT governance and DCOC (p-value > 0.05), no supporting H6b. In contrast, the no hypothesized moderating role of environmental dynamism on the effect of dynamic capability innovation capability (β =−0,142; p-value < 0.05) is negative, implying that dynamic capabilities innovation capability has a weaker effect as the environment becomes more dynamic, no supporting H6a. There was a presence of environmental dynamism in the relationship between DCOC and CP (β=0,159; p-value < 0.05), supporting H7b, and in the relationship between DCIC and CP, there is no presence of dynamism (p-value > 0.05), no supporting H7a.

4.5. Heterogeneity and Subgroup Analysis

To test hypothesis H8, It was employed the finite mixture partial least squares (FIMIX-PLS) algorithm (Hair et al., 2016), to examine if there are factors that are not included in the proposed model that explain differences across segments groups of the firm. Hence, the FIMIX-PLS algorithm was applied to provide more fine-grained results, and accounting for unobserved heterogeneity. The FIMIX-PLS algorithm was executed 10 times for g = 2–5 segments, using the Akaike Information Criterion (AIC), Modified AIC with Factor 3 (AIC3), Bayesian Information Criterion (BIC), Consistent AIC (CAIC), Hannan-Quinn Criterion (HQ), and the normed Entropy Statistic (EN) as indicators to identify the appropriate segmentation solution (Becker, Rai, Ringle, & Volckner, 2013; Matthews et al., 2016). The FIMIX-PLS indicated that the two-segment solution is the most appropriate (jointly BIC and CAIC criterion and EN > 0.5), as proposed by Hair et al. (2017). Also, it did not consider solutions with more than the three segments, because the smallest subgroup size attains levels of less than the minimum

sample size (50 cases). Thus, the two-subgroup solution represent 1-segment with $\pi 1 = 0.67$ and a 2-segment with $\pi 2 = 0.33$, see Table 5.

Table-5. FIMIX-PLS evaluation criteria.

S	AIC	AIC3	AIC4	BIC	CAIC	HQ	MDL5	EN	Relative Segment Sizes (g)				
									1	2	3	4	5
2	1.175,4	1.240,4	1.305,4	1.369,8	1.434,8	1.254,4	2.667,3	0,76	0,67	0,33			
3	1.133,9	1.225,9	1.317,9	1.409,0	1.501,0	1.245,7	3.245,5	0,79	0,51	0,40	0,09		
4	1.088,6	1.211,6	1.334,6	1.456,4	1.579,4	1.238,1	3.911,7	0,87	0,61	0,23	0,08	0,08	
5	1.037,2	1.191,2	1.345,2	1.497,7	1.651,7	1.224,3	4.571,8	0,87	0,38	0,38	0,10	0,08	0,06

Note: S: Segment, AIC: Akaike Information Criterion; AIC3: Modified AIC with Factor 3; BIC: Bayesian Information Criterion; CAIC: Consistent AIC; HQ: Hannan-Quinn Criterion; EN: Entropy Statistic.

To examine the hypothesis H8, it was compared to the segment of 1 and 2 by applying the multi-group analysis partial least square (PLS-MGA) algorithm. The finding of the multigroup analysis and the significance of the difference between the two group paths and explanation coefficients (R^2) were reported in Table 6, supporting H8.

The effect of ITG on DCIC, it was found that 2-segment demonstrated a greater ($\beta = 0.680$, $t = 5{,}897$, $p < 0.001$) and statistically significant difference, compared to 1-segment ($\beta = 0.075$, $t = 0{,}628$, $p > 0.05$). The moderation effect of environmental dynamism was present in the negative influence in the relationship between ITG on DCIC ($\beta = -0.226$, $t = 2.109$, $p < 0.05$), whereas in 2-segment it was rendered as non-significant ($\beta = -0.140$, $t = 1.120$, $p > 0.05$).

IT governance exerted a strong influence on DCOC in the 1-segment ($\beta = 0.619$, $t = 7.545$, $p < 0.001$) than in 2-segment ($\beta = 0.316$, $t = 2.328$, $p < 0.05$). The moderation of dynamism demonstrated positive strong influence in the relationship between ITG on DCOC in the 1-segment ($\beta = 0.138$, $t = 2.533$, $p < 0.05$), whereas in 2-segment it was rendered as non-significant ($\beta = -0.197$, $t = 1.744$, $p > 0.05$).

Concerning the effect of DCIC on CP, the 2-segment showed a greater ($\beta = 0.825$, $t = 12.898$, $p < 0.001$), and statistically significant difference (0.633, $p<0.001$), compared to 1-segment ($\beta = 0.192$, $t = 1.429$, $p > 0.05$). However, the influence of DCOC on CP, in the 1-segment demonstrated statistically significant ($\beta = 0.386$, $t = 3.100$, $p < 0.001$), and in the 2-segment it was not present significance statistic ($\beta = 0.113$, $t = 1.541$, $p > 0.05$).

Finally, the moderation effect of dynamism in the relationship between DCIC and CP, and DCOC and CP for both segments (1 and 2) were non-significant ($p > 0.05$).

Table-6. Global model and MGA-PLS results for two subgroups.

Variables relationship	Global	1-Segment	2-Segment	Path Coefficients Diff. |S1-S2|	PLS-MGA	Parametric Test	Welch-Satterthwait Test
ITG -> DCIC	0,283***	0,075	0,680***	0,605	Sig. ***	Sig. ***	Sig. ***
DCOC -> DCIC	0,361***	0,452***	0,319**	0,133	n.sig	n.sig	n.sig
DYN*ITG->DCIC	-0,142*	-0,226*	-0,140	0,139	n.sig	n.sig	n.sig
ITG -> DCOC	0,584***	0,619*	0,316**	0,303	n.sig	Sig. *	n.sig
DYN*ITG->DCOC	0,069	0,138*	-0,197	0,335	Sig. ***	Sig. **	Sig. **
DCIC -> CP	0,358***	0,192	0,825***	0,633	Sig. ***	Sig. ***	Sig. ***
DCOC -> CP	0,362***	0,386**	0,103	0,283	Sig.*	n.sig	n.sig
DYN*DCIC->CP	-0,053	-0,161	-0,065	0,096	n.sig	n.sig	n.sig
DYN*DCOC->CP	0,159*	0,257*	0,036	0,222	n.sig	n.sig	n.sig
Sector -> CP	-0,087	-0,069	-0,058	0,011	n.sig	n.sig	n.sig
Size -> CP	0,167*	0,097	0,248***	0,150	n.sig	n.sig	n.sig
R^2 (DCIC)	0,494	0,401	0,810	0,409	Sig. ***	Sig. ***	Sig. ***
R^2 (DCOC)	0,430	0,436	0,434	0,002	n.sig	n.sig	n.sig
R^2 (CP)	0,531	0,376	0,939	0,563	Sig. ***	Sig. ***	Sig. ***

The next step is to turn unobserved heterogeneity into observed heterogeneity through making segments accessible, as recommended by Becker et al. (2013). It was used cross tabs to translate the latent segment structure to examine the frequency distribution of segments 1 and 2, by partitioning the data using more exploratory variables, see Table 7.

Table-7. Cross tab of FIMIX-PLS segment.

Observed Variables		PLS-FIMIX Segments			Sample Percentage by PLS-FIMIX Segment		
		1	2	Sum	1	2	Sum
Competitive strategies	Prospector	37	29	66	56%	**44%**	45%
	Analyzer	24	18	42	57%	**43%**	29%
	Defender	28	14	42	**67%**	33%	29%
	Reactor	6	0	6	**100%**	0%	4%
Level of Dynamism	Low	14	4	18	**78%**	22%	12%
	High	81	48	129	63%	**37%**	88%
Sector	Commerce	9	3	12	**75%**	25%	8%
	Financial	17	17	34	50%	**50%**	23%
	Manufacturing	14	14	28	50%	**50%**	19%
	Services	55	18	73	**75%**	25%	50%
Firm Age (years)	Young (until 9.9)	11	4	15	**73%**	27%	10%
	Medium (10 until 19.9)	18	11	29	62%	**38%**	20%
	Maturity (above 20)	66	37	103	64%	**36%**	70%
Firm Size (number of employees)	Small (until 49)	10	3	13	**77%**	23%	9%
	Medium (50 until 499)	25	6	31	**81%**	19%	21%
	Large (above 500)	60	43	103	58%	**42%**	70%

The results demonstrated that the segments can be separated into explanatory variables based on environmental dynamism, competitive strategies, sector, firm-age, and firm-size. The 1-segment is characterized by defender and reactor competitive strategies, low level of dynamism, commerce and service sectors, young firm age, and small and medium firm-size. Companies in the 2-segment showed more percent of prospectors and analyzer competitive strategies by Miles and Snow(Miles et al., 1978), high level of environmental dynamism, financial and manufacturing sectors, firms above ten years of age, and large companies above 500 employees.

5. DISCUSSION AND CONCLUSIONS

This study aimed to examine how the IT capabilities, captured through the interplay of IT governance capability, positively influences dynamic capabilities innovation and operational capabilities, and in turn, leads to corporate performance gains under an uncertain environment of dynamism. The proposed model had high explanatory power in terms of R^2, above 43%, for all endogenous variables (Hair et al., 2017). Furthermore, the conceptualization of second-order IT governance capability as stemming from the first-order IT capabilities through IT strategy, IT architecture, IT infrastructure, IT business knowledge, and IT management, has not been previously subject to large scale empirical testing, and also extend the knowledge of dynamic capabilities and IT governance, as recommended to investigate into a variety of different classification methods from both disciplines of management (Teece, 2018; Teece et al., 2016) and IT (Khalil & Belitski, 2020). In sum, the current article shows four key findings.

Firstly, it was found empirical support for the claim that IT governance capability facilitates the emergence of dynamic capabilities innovation and operational capabilities, thus, confirming H1 and H2. This finding essentially means that IT governance departing from alignment among business strategy and IT strategy, IT architectures transitioning to IT infrastructures as the base foundation that support IT knowledge management by business application needs [purchase and (or) develop], and IT management to prioritize investment, allows firms to construct IT-based dynamic capability innovation capability that is critical to gain corporate performance. This result confirms other previous studies that IT use increase is required to support key activities to create innovation, and extend the knowledge literature of IT capabilities (Aral & Weill, 2007; Mikalef, Krogstie, Pappas, & Pavlou, 2019; Yoshikuni & Albertin, 2018). For example, big data, business intelligence, and business analytics support firms to detect trends, sense external signals of change, to attend shifting customer preferences, and customer ascertain opinions frequently by IT (Olszak & Zurada, 2020). On the other hand, IT governance capability also facilitates better information sharing and communication enabling internal business processes to rapidly adapt triggered through the market and other stimuli. Therefore, the strategic IT alignment allows the design and

creation of IT architecture upon which IT infrastructure (such as application of ERP, SCM, CRM, big data, big analytics, business intelligence, and others IT resources) are prioritized, bought, or developed as a foundation to launch digital solutions to enable dynamic capabilities (Li & Chan, 2019). Moreover, this empirical research investigated IT governance capability as a second-order construct to enable the ability to make better decisions to the use of IT and adopted alternative classification method from both dynamic capabilities and IT capabilities, and hence, it contributed to this novel empirical study and expands the knowledge of IT governance in the context of a developing country, as recommended by Khalil and Belitski (2020) and dynamic capabilities literature (Teece, 2018)

Secondly, the empirical find supports hypothesis H3 that dynamic capability operational capability can be a mediator when the value of dynamic capabilities is an accelerator of the operational business process to be responsive to changes in the environment. This result corroborates previous studies (Aslam et al., 2018; Lu & Ramamurthy, 2011; Mikalef & Pateli, 2017) when demonstrating that dynamic capability operational capability enables firms to systematical undertake market sensing activities and environmental factors that allow an understanding of market conditions as well as for prediction purposes to remain synchronized with market changes to make innovation with superior value propositions. Hence, this study contributes to IT governance literature by understanding how dynamic capability operational capability can promote the mediating effect in the relationship between IT governance and innovation capabilities, and address the issue required by Khalil and Belitski (2020).

Thirdly, the findings indicate that dynamic capabilities have a positive and significant effect on a firm's corporate performance, confirming H4 and H5. This outcome highlights the strategic use of IT provide by IT governance can lead to significant dynamic capabilities to enhance corporate performance gains. Hence, this study prolongs the knowledge of IT capabilities literature, in line with previous empirical surveys have examined the effect of the ability to sense emerging threats and opportunities and seize them by employing IT-based capabilities (Lu & Ramamurthy, 2011; Mikalef & Pateli, 2017; Pavlou & El Sawy, 2010). However, they did not examine the dynamic capabilities to lead efficiency and effectiveness of responding to changes and opportunities through antecedents second-order construct of IT governance capability, thus, this study extends the dynamic capabilities literature as mentioned by Teece (2018) that dynamic capabilities framework is still relatively in its infancy and need further elaboration and clarification to help executives toward improved prospects for a sustained high performance longer term.

Fourthly, the result of the empirical did not support the hypothesis H6a and H6b, because environmental dynamism showed negative effects on the relationship between IT governance and dynamic capability innovation capability. In the relationship between IT governance and dynamic capability, the operational capability demonstrated no influence of dynamism moderation, i.e., the relationship among IT governance and dynamic capability operational capability maintains the same effect with high or low environmental dynamism. This finding differs from previous empirical studies that investigated the first-order IT capabilities positively influence innovation capabilities in the context of a developed economy (Kim et al., 2011; Mikalef et al., 2020; Mikalef & Pateli, 2017; Pavlou & El Sawy, 2010). Even though Brazil is the 8th largest economy in the world (CIA, 2020), as emergence economy, since 2014 the Brazilian GDP oscillates between negative values and 1%, added to the 2020 period that projects a negative GDP less than 5%. Hence, major Brazilian firms may have had restrictions with IT knowledge (reduction of staff) and IT management investment to promote innovation, and on the other hand, many firms had a focus on IT capabilities to cut expenses through reconfiguring internal business processes to be more efficiency enhance productivity.

Fifthly, the findings indicated that the environmental dynamism did not influence the relationship between dynamic capability operational and corporate performance, thus, it doesn't support H7a. While the result confirms hypothesis H7b indicating that dynamism amplifies the effects in the relationship between dynamic capability operational capability on corporate performance. So, this study contributes to IT capabilities literature, in line with current studies (Aslam et al., 2020; Aslam et al., 2018; Kim et al., 2011; Kohli & Grover, 2008; Melville et al., 2004;

Mikalef & Pateli, 2017; Yoshikuni & Albertin, 2018) that IT capabilities increased proficiency in changing its business process chain capabilities through flexibility and connecting business parties, reducing process cost, and capitalizing business intelligence and analytics information to leverage firm performance.

Sixthly, the study assessed the potential effect of the heterogeneous influence of IT governance and dynamic capabilities on corporate performance. The results indicated two distinct segments of firms with different characteristics of competitive strategies, firm-age, firm-size, firm-sector, and influence of environmental dynamism, confirming hypothesis H8. The 1-segment (95 cases) demonstrated firms' strategic orientation defender and reactor receive less influence of dynamism, they have strong positive effects in the relationship between IT governance on dynamic capability operational capability, and subsequently on corporate performance; and dynamism moderation amplify effects (more 66%) in the relationship between dynamic capability operational capability on corporate performance for young firms, belong to commerce and services sectors, and small and medium-size. Hence, firms that belong to the 1-segment reinforces that IT governance construct has a critical importance of dynamic process management capabilities in enhancing corporate performance, as stated in the hypotheses H2, H5, and H7b. On the other hand, 2-segment (52 cases) demonstrated that firms' strategic orientation prospector and analyzer, receive a high influence of dynamism, they have a strong positive effect in the relationship between IT governance on dynamic capability innovation capability, and subsequently strong positive impact on corporate performance for medium and maturity firm-age, belong to manufacturing and financial sectors, and large firm-size; and dynamic capability innovation capability was full mediation in the relationship between dynamic capability operational capability on corporate performance. These findings indicated that a specific group of firms used IT to develop the ability to sense market opportunities correctly and operational capability to capitalize on them to enhance corporate performance, in line with the current IS studies (Mikalef et al., 2020; Mikalef & Pateli, 2017; Yoshikuni et al., 2018). This outcome denotes that in complex environments that require to capture, analyze, process a large amount of information, and adjust the operational process, developing strong dynamic capabilities through IT governance capability can be seen as a prerequisite for different types of organizations. Furthermore, this study contributes to knowledge of the literature of IT governance and dynamic capabilities, when raises the importance to examine the other factors conditions, such as uncertain environment, competitive strategy, firm-age, firm-size, and sector, by heterogeneity lens, as a condition under which dynamic capabilities and specifically IT governance-enabled dynamic capabilities result in increased corporate performance.

5.1. Practical Implications

This study provides implications for executives related to how IT governance capability is an important drive to enhance corporate performance. The findings demonstrated that IT capabilities (as first-order variable in the second-order IT governance capability) play a fundamental role in corporate performance gains and generating economic payoff from IT resources through dynamic capabilities.

Effective IT governance to make better decisions require that firms develop IT capabilities and consider the diversity of characteristics that comprise IT strategy, IT architectures, IT infrastructure, IT business knowledge, and IT management, since IT governance capability facilitates rapid repositioning of firms' to attend response to the market, demand changes or opportunity arises by rapidly restructuring its internal business processes adjustment.

Therefore, the benefits of IT governance capability can be realized when business strategy is aligned with IT, and consequence with the organizational IT architecture and IT infrastructure are projected to support and incorporate (rapidly, flexible, modular, with less risk) the business needs application and IT investments. The findings showed that managers have careful consideration of the firm's orientation strategy resulting in IT alignment with business objectives, competition sector, and firm-size, and maturity. The dynamism effects can

ensure that there is a specific correspondence between IT governance and dynamic capabilities to enhance corporate performance, i.e., IT governance may promote different benefits to enable business value.

Finally, the result demonstrated the firm's orientation strategy of prospector and analyzer, in the case of high dynamism, IT governance and dynamic capability innovation capability is of heightened importance to enhance corporate performance, i.e., in such conditions, IT governance can allow firms to be more responsive to develop innovation to attend to market needs. In conditions of low dynamism, on the other hand, the firm's orientation strategy of defender and reactor, the impact of dynamic capability operational capability is considerably strong to enhance corporate performance. Hence, firms should carefully assess the tradeoffs between the value of IT governance-enabled dynamic capabilities, depending on the orientation strategy, sector competition, firm-size, and maturity, i.e., the complex environment in which organizations are operating.

5.2. Limitations and Future Research Directions

The present study demonstrated limitations and further research should be developed. The potential of biases cannot be excluded because the perceptual nature of the data, the use of a single key informant, could be the root cause of bias and that the factual data does not coincide with the respondents' perceptions. Although this research relies on senior respondents as key informants, future research could sample multiple respondents from a single firm that would be useful to mitigate possible biases and check for inter-rater validity, and to improve internal validity.

To the best of the author's knowledge, the underlying five IT capabilities to comprise second-order IT governance cannot be considered exhaustive, but just represent core IT governance capability of focus. Future studies can be conducted towards novel capabilities of interest, such as dynamic information technology capability; the meaning of the opportunities facilitated by the set of ordinary capabilities that each dynamic IT capability component creates, and reconfigures to enable organizational agility and outcomes firm performances.

In considering the investment that firms incurred in developing each IT governance capability through orientation strategy, sector, and other firms' characteristics, and the limitation of firms have based in the developed economy, further research could also investigate the IT governance-enabled dynamic capabilities in different contexts of the developed economy.

Funding: This study received no specific financial support.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

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Appendix-A. Measurement items for constructs.

IT Governance Capability

IT Strategy (ITS)

Please rate how well ITS alignment with business strategy

[ITS_1] The IT plan contains detailed action plans/strategies that support the organization's business objectives and strategies.

[ITS_2] The goals/objectives of IT are aligned with the goals/objectives of the organization

[ITS_3] The IT unit participates in the elaboration of the business strategy

[ITS_4] The IT unit is organized and structured in such a way that the desired behaviors of IT reflect the reason for the existence of the area (IT mission) for the organization.

IT Architecture (ITA)

Please rate how well ITA …

[ITA_1] supports the company's value chain.

[ITA_2] supports the integration of the company's core processes

[ITA_3] supports the integration of data from the company's core processes

[ITA_4] supports the generation of information from the company's core processes

[ITA_5] is built to facilitate the standardization and integration of business processes and data.

[ITA_6] established corporate rules and standards IT infrastructure and applications to enable processes and data integration.

IT Infrastructure (ITI)

Please rate how well ITI…

[ITI_1] supports critical processes to achieve the company's strategic objectives.

[ITI_2] supports processes, data, and information is widely shared to management make better decisions

[ITI_3] has a plan and executes a routine to keep support technologies up to date.

[ITI_3] has standards rules and practices for outsourced services (business partners).

IT Business Knowledge (ITBK)

Please rate how well ITBK

[ITBK_1] IT unit understand our organization's policies and plans at a very high level.

[ITBK_2] IT unit is capable of interpreting business problems and developing appropriate solutions

[ITBK_3] IT unit is knowledgeable about the necessity of business functions.

[ITBK_4] IT unit is capable to attend business needs met within the standards of IT architecture

IT Management (ITM)

Please rate how well ITM

[ITM_1] IT investment decisions prioritize changes or process improvements that are strategically more important for the company

[ITM_2] IT investment decisions, we think about and estimate the effect they will have on the innovation and productivity of the firm

[ITM_3] IT investment decisions assess the impact of the business value of IT projects determined following their implementation

Dynamic Capability Innovation Capability

Please rate how well your organization is in building innovation capabilities

My company…

[DCIC_1] constantly seek new opportunities;

[DCIC_2] frequent observed events and trends about the future implications to create new products, services, and business models

[DCIC_3] quick to implement appropriate incremental change in the product, service, and business model in the face of market/customer need.

[DCIC_4] strategically eliminate products/services in the late stages of the life cycle

Dynamic Capability Operational Capability

Please rate how well your organization is in building operational capabilities

My company…

[DCOC_1] can quickly scale up or scale down our production/service levels to support fluctuations in demand from the market;

[DCOC_2] if there is a disruption in supply from our suppliers, it can quickly make necessary alternative arrangements and internal adjustments

[DCOC_3] fulfill demands for rapid-response, special requests of their customers whenever such demands arise; their customers have confidence in our ability.

[DCOC_4] can quickly develop new suppliers according to new demands from customers

Corporate Performance By BSC

Please rate how well your organization achieve corporate performance

Financial performance (FP)

[FP_1] The company reaches its goals of profitability to satisfy shareholders.

[FP_2] The business is efficient in terms of spending [i.e., cost management, expenses, and investments) to meet productivity goals.

[FP_3] The company reaches its goals concerning revenues.

[FP_4] The organization has a competitive advantage over competitors

Market Performance (MP)

[MP_1] Customers remain loyal to the company.

[MP_2] The market associates the company's image (brand) with the quality of the services and/or products it represents.

[MP_3] Customers are satisfied with the value provided by the company.

Internal Process Performance (IPP)

The firm is efficient and effective in promoting…

[IPP_1] business process innovation.

[IPP_2] business process operations.

[IPP_3] business process post-sale activities

Growth and Learning Performance (GLP)

[GLP_1] Employees are satisfied with the human capital policies (attraction, retention, and development)

[GLP_2] The company is recognized by the market as a good place to work.

[GLP_3] Employees have the essential skills to manage their routine and strategic activities.

[GLP_4] The company is admired by its employees.

Environmental Dynamism (DYN)

Please rate the environmental dynamism of your organization

[DYN_1] Products and services in our industry become obsolete very quickly

[DYN_2] The product/services technologies in our industry change very quickly

[DYN_3] Firm can predict what our competitors are going to do next

[DYN_4] Firm can predict when our products/services demand changes

Measured Latent Marker Variable (MLMV)

Please rate the view about your life

[MLMV_01] It is easy for me to reach my goals.

[MLMV_02] I would never abandon the desire to have my own business.

[MLMV_03] I have a positive attitude towards others.

[MLMV_04] I always imagine my house in the future.

Appendix-B. Factor loadings (bolded) and cross loadings of reflective constructs.

Items	ITP	ITA	ITI	ITKM	ITM	DCIC	DCOC	FP	MP	IPP	GLP	DYN
ITS_1	**0,833**	0,526	0,540	0,564	0,552	0,527	0,449	0,325	0,391	0,476	0,458	0,394
ITS_2	**0,825**	0,369	0,426	0,449	0,409	0,409	0,332	0,497	0,369	0,472	0,255	0,241
ITS_3	**0,920**	0,568	0,573	0,560	0,501	0,421	0,413	0,346	0,427	0,510	0,312	0,292
ITS_4	**0,854**	0,600	0,658	0,623	0,657	0,419	0,470	0,400	0,393	0,533	0,445	0,258
ITA_1	0,500	**0,863**	0,639	0,489	0,365	0,421	0,489	0,301	0,345	0,479	0,279	0,209
ITA_2	0,551	**0,918**	0,656	0,525	0,446	0,480	0,502	0,313	0,323	0,499	0,360	0,292
ITA_3	0,526	**0,913**	0,650	0,553	0,556	0,484	0,545	0,338	0,363	0,484	0,422	0,375
ITA_4	0,465	**0,898**	0,647	0,532	0,477	0,382	0,514	0,322	0,338	0,479	0,370	0,260
ITA_5	0,537	**0,845**	0,675	0,579	0,535	0,474	0,563	0,486	0,368	0,576	0,382	0,346
ITA_7	0,596	**0,770**	0,638	0,539	0,615	0,439	0,442	0,370	0,335	0,476	0,353	0,380
ITI_1	0,626	0,693	**0,829**	0,564	0,531	0,510	0,436	0,353	0,499	0,527	0,471	0,313
ITI_2	0,606	0,676	**0,864**	0,675	0,570	0,517	0,481	0,377	0,434	0,550	0,531	0,301
ITI_4	0,358	0,515	**0,754**	0,591	0,602	0,366	0,407	0,361	0,275	0,397	0,343	0,184
ITI_6	0,442	0,480	**0,734**	0,553	0,618	0,342	0,408	0,438	0,508	0,418	0,390	0,162
ITBK_1	0,583	0,520	0,625	**0,845**	0,734	0,448	0,416	0,446	0,384	0,450	0,486	0,383
ITBK_2	0,624	0,677	0,742	**0,835**	0,566	0,479	0,579	0,410	0,391	0,548	0,421	0,335
ITBK_3	0,501	0,423	0,568	**0,844**	0,608	0,399	0,425	0,414	0,490	0,494	0,472	0,142
ITBK_4	0,424	0,406	0,536	**0,825**	0,583	0,495	0,447	0,320	0,378	0,423	0,480	0,254
ITM_1	0,623	0,543	0,662	0,693	**0,885**	0,473	0,440	0,402	0,488	0,493	0,603	0,333
ITM_2	0,457	0,435	0,561	0,603	**0,900**	0,389	0,410	0,373	0,416	0,397	0,477	0,354
ITM_3	0,573	0,544	0,686	0,678	**0,880**	0,464	0,420	0,337	0,489	0,426	0,479	0,320
DCIC_1	0,420	0,392	0,475	0,500	0,409	**0,870**	0,442	0,421	0,414	0,529	0,450	0,313
DCIC_2	0,443	0,422	0,455	0,400	0,370	**0,871**	0,495	0,379	0,341	0,470	0,461	0,312
DCIC_2	0,501	0,376	0,398	0,356	0,315	**0,815**	0,459	0,422	0,466	0,503	0,417	0,332
DCIC_3	0,311	0,379	0,413	0,466	0,473	**0,622**	0,569	0,338	0,386	0,388	0,447	0,351
DCIC_4	0,429	0,514	0,493	0,482	0,463	**0,873**	0,505	0,404	0,356	0,551	0,476	0,426
DCOC_1	0,401	0,551	0,513	0,440	0,432	0,550	**0,796**	0,368	0,353	0,458	0,441	0,440
DCOC_2	0,440	0,490	0,461	0,460	0,428	0,470	**0,858**	0,368	0,297	0,468	0,363	0,344
DCOC_3	0,298	0,386	0,321	0,415	0,230	0,432	**0,825**	0,392	0,359	0,503	0,322	0,224
DCOC_4	0,458	0,493	0,474	0,536	0,451	0,539	**0,833**	0,465	0,426	0,577	0,473	0,293
FP_1	0,370	0,322	0,386	0,404	0,370	0,370	0,365	**0,938**	0,543	0,545	0,453	0,249
FP_2	0,441	0,367	0,452	0,490	0,440	0,400	0,435	**0,909**	0,551	0,604	0,471	0,302
FP_3	0,364	0,204	0,342	0,325	0,315	0,363	0,305	**0,866**	0,578	0,499	0,478	0,084
FP_4	0,389	0,501	0,460	0,429	0,324	0,534	0,545	**0,781**	0,589	0,590	0,442	0,261
MP_1	0,411	0,282	0,376	0,307	0,272	0,273	0,326	0,657	**0,752**	0,518	0,461	0,144
MP_2	0,425	0,384	0,537	0,491	0,493	0,452	0,425	0,474	**0,886**	0,609	0,502	0,252
MP_3	0,278	0,291	0,381	0,370	0,500	0,436	0,293	0,464	**0,782**	0,466	0,461	0,211
IPP_1	0,493	0,501	0,540	0,483	0,451	0,390	0,488	0,556	0,565	**0,871**	0,438	0,257
IPP_2	0,496	0,496	0,499	0,453	0,447	0,415	0,531	0,507	0,584	**0,856**	0,389	0,283
IPP_3	0,439	0,417	0,432	0,481	0,319	0,690	0,473	0,527	0,472	**0,728**	0,433	0,326
GLP_1	0,239	0,199	0,262	0,348	0,377	0,138	0,237	0,311	0,319	0,272	**0,749**	0,159
GLP_1	0,488	0,478	0,568	0,581	0,537	0,576	0,419	0,546	0,486	0,534	**0,834**	0,292
GLP_2	0,309	0,266	0,429	0,415	0,507	0,457	0,442	0,416	0,549	0,394	**0,872**	0,132
GLP_3	0,378	0,389	0,516	0,471	0,530	0,569	0,498	0,458	0,574	0,461	**0,912**	0,231
DYN_1	0,279	0,236	0,230	0,208	0,263	0,307	0,314	0,205	0,180	0,242	0,187	**0,795**
DYN_2	0,151	0,233	0,185	0,166	0,247	0,224	0,279	0,317	0,293	0,251	0,201	**0,695**
DYN_3	0,292	0,327	0,242	0,271	0,295	0,367	0,341	0,186	0,269	0,278	0,192	**0,826**
DYN_4	0,332	0,312	0,291	0,380	0,357	0,409	0,319	0,162	0,094	0,318	0,207	**0,811**