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The Effect of Cross-functional Integration on Organizational Performance: A Look at Collaboration, Coordination, and Communication

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THE EFFECT OF CROSS-FUNCTIONAL INTEGRATION ON ORGANIZATIONAL PERFORMANCE: A LOOK AT COLLABORATION, COORDINATION, AND COMMUNICATION

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by

Loraine A. Jackson

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To: Interim Dean William Hardin
College of Business

This dissertation, written by Loraine A. Jackson and entitled The Effect of Cross-Functional Integration on Organizational Performance: A look at Collaboration, Coordination, and Communication, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Florida International University, 2021

DEDICATION

I dedicate this dissertation to my husband and family. The completion of work would not be possible without their understanding, patience, love, and support.

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I wish to thank the members of my committee for their support, patience, and understanding. I am grateful for their constant direction, insight, and encouragement throughout the process. I want to thank my major professor, Dr. George Marakas, who was instrumental from the beginning of the program in guiding me through the process and get me to the point of theory and methodology. His expertise in business administration was vital for the preparation of my proposal. I would also like to thank my committee chair, Dr. Yan Chen, for guiding me to the finish line. She had confidence in my abilities to complete this degree. Her passion and dedication to motivate, engage, and educate are very inspirational.

I was very fortunate to work with brilliant professors throughout the program who motivated and encouraged my creativity. The DBA program coursework provided me with the tools to explore both past and present issues and ideas.

ABSTRACT OF THE DISSERTATION

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Professor George Marakas, Major Professor

Cross-functional integration (CFI) in organization involves a sequence of integrated tasks and activities across multiple departments and units. Modern organizations are hierarchical and have separated functional departments. This may lead to limited reciprocal communication and poor coordination. Work is often divided, categorized, and poses a challenge for CFI personnel to be practical. This challenge continues as technology and organizational structures change.

This study is to investigate the effect of CFI on organization performance. The study also looked at CFI from a triadic level of analysis, a broader perspective involving several functional units and processes within the organization. Specifically, this study examines how collaboration, coordination, and communication as the three core processes of CFI impact organization performance and develops a research model based on Tushman & Nadler's (1978) information processing framework. The study also incorporates the organizational structure (OS) by testing the moderated effect between CFI and performance. We tested the model via a survey that included 325 completed

survey responses from online participants. The results showed a strong positive impact of collaboration, coordination, and communication on performance. Also, the study revealed that organizational structure partially moderates the relationships between CFI and performance. There was a strong interaction effect on the relationship between coordination and performance, and communication and performance. However, we found no relationship between collaboration and performance with the inclusion of the organizational structure. Implications of these findings are discussed, along with suggestions for future research.

Keywords: Cross-functional Integration, inter-functional collaboration; interdepartmental integration, information processing, collaboration, coordination, communication, OS

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ABBREVIATIONS AND ACRONYMS

CFI	Cross-Functional Integration
IPT	Information Processing Theory
OS	Organizational Structure

I. INTRODUCTION

Today's business environment is a process of constant change and has become the norm. As a result, companies modify their strategies to focus on organizational flexibility and continuous improvement, but not without challenges (Weick & Quinn 1999; Merschmann & Thonemann 2011). Many organizations face circumstances where quick decision-making becomes necessary for a more robust and accessible flow of knowledge to improve their structures (Hietajarvi, Aaltonen, & Haapasalo, 2017). One such area is the CFI of functions within an organization for better firm performance (Turkulainen & Ketokivi, 2012).

Throughout time, companies have adapted the process of grouping people, activities, and resources into processes, creating cross-functional relationships that, through coordination and collaboration, they can meet their company's needs and demand (Harris, 2005; Galpin, Hilpirt, & Evans, 2007). According to Tesone (2006), many companies are experiencing the inability to effectively carry out integration processes among departments and individuals (Tesone, 2006). If one department's communication or process breaks down, this affects another and will ultimately impact the organization's complete performance experience (Reddock, 2017).

Looking at CFI as a potential problem stems from the fact that a company I work for within the financial industry faced several challenges in streamlining its cross-functional activities. Departments such as sales/marketing, operations, R & D, guest services, accounting, and engineering do not work well together to achieve their goals. Several efforts to fix these problems have failed as there is a lack of coordination and communication among departments and their functions. Therefore, management needs to

find solutions to increase communication efforts among the departments and believes that improving cross-functional collaboration will significantly achieve a successful firm performance. So, the emphasis is on looking at cross-functional processes and how they affect performances to help solve this issue for organizations.

The need to facilitate coordination between departments within a company has developed CFI, which has become necessary to succeed in today's market. (Rho, Hahm & Yu, 1994; Griffin & Hauser, 1996; Krohmer, Homburg, & Workman, 2002; Daugherty, Chen, Mattioda & Grave, 2009; Pimenta, 2016). Prior research focused on the relationship between integration and performance, and many researchers have found that better integration levels improve performance (Gimenez & Ventura, 2003; Stock, Greis, & Kasarda, 1998). Previous studies focus on integration relationships from a dyadic analysis level, such as marketing & logistics (Ellinger, Daugherty, & Keller, 2000; Stank, Daugherty, & Ellinger, 1999), manufacturing & marketing (O'Leary-Kelly & Flores, 2002; Prabhaker, Goldhar, & Lei, 1995; Verma, Thompson, Moore, & Louviere, 2001), and R & D and marketing (Griffin & Hauser, 1996).

Purpose Statement

The purpose of this survey research study is to examine the relationship between CFI (as it relates to collaboration, coordination, and communication) and organizational performance. This study extended the CFI research by shifting the focus to looked at CFI from a triadic analysis level to include a wider-based integration that encompasses several different functional units and processes within the organization. Input from various operating units could facilitate greater cooperation, develop mutual understanding, support collective goals, and plans to enhance and resolve operational

problems (Chen, Mattioda, & Daugherty, 2007; Stank et al., 1999). Also, to add to the literature, a look at the organizational structure is considered as an interaction effect. That is, how can OS facilitate integration and improve CFI. We believe that elaborating on the relationship between CFI work processes and performance will explain why these are important.

Significance of the Study

Cross-functional activities are challenging (Turkulainen, & Ketokivi, 2012; Hietajärvi, et. al., 2017). From a micro-level, this study's significance will be to provide quantitative evidence of the impact and effectiveness of CFI processes, mainly collaboration, coordination, and communication, on a firm's performance. The population of cross-functional teams has increased over time due to the need for increased coordination, integration, improved organizational boundaries, and production (Shams, Vrontis, Weber & Tsoukatos, 2018). At the macro level, the aim is to contribute to the literature, as this is not just one organizational problem but also a national one. Also, to provide information for applied business leaders who might experience integration problems and find this information helpful for daily activities. Bringing people together from various skill sets and departments can improve problem-solving and thorough decision-making (Turkulainen, & Ketokivi, 2012; Bendoly, Bharadwaj, & Bharadwaj, 2012). Finally, to ultimately improve practices and policies in general in the area of achieved CFI. Therefore, the main research question is, "what is the effect of CFI on organizational performance regarding collaboration, coordination, and communication?"

II. LITERATURE REVIEW

Introduction

The topic under study is "what is the effect of CFI on performance as it relates to collaboration, coordination, and communication? " CFI is also referred to as inter-departmental integration, internal integration (Kahn, 1996), and inter-departmental collaboration (Danaoski, 2010; Lee, 2020. Kwan (2019) also refers to CFI as cross-group collaboration (Kwan, 2019).

While there has been much research on CFI, only a few studies have looked at the problems from a triadic approach, including all aspects of a firm processes and departments (Chen et al., 2007). Appendix A gives a list of some empirical studies on CFI. In addition, minimal research has considered the OS a potential player in the relationship between CFI and performance (Chen et al., 2007). This section summarizes the various literature explored that may be applicable in addressing some of the work processes and factors affecting organizations to achieve CFI successfully. The first part looks at the different definitions of CFI and integration in general.

Integration Definition

There are varied definitions from several publications about the nature and clarity of concepts relating to CFI. The description of organizational integration dates to pioneers Lawrence & Lorsch's (1967, 1986, p. 11) and Barki & Pinsonneault (2005), who defined work process integration as "a state of interdepartmental relations to achieved integration" (Lawrence & Lorsch, 1986, p. 11). The focus is on achieving integration, which seems to be a problem. When there is high "achieved integration," the organization operates in unity. Functional sub-unit do not pursue their agenda but focus

on the goal of the organizations. When there is low integration, everyone is on their own schedule (March & Simon, 1993; Boyer & McDermott, 1999; Ketokivi & Castaner, 2004; Turkulainen, & Ketokivi, 2012).

A universally accepted integration definition is that of Kahn & Metzer (1998), which stated that integration involves interdepartmental collaboration and interaction that unite departments together into a cohesive organization (Kahn & Metzner, 1998; Chen et al., 2007). Another definition was created by O'Leary-Kelly & Flores (2002), defining integration as different units working together cooperatively to arrive at a mutually acceptable outcome (O'Leary-Kelly & Flores, 2002).

Pellathy et al. (2019) provided the latest comprehensive overview of essential concepts and definitions around CFI. According to Pellathy et al. (2019), "cross-functionality is an ongoing process of collaboration, coordination, and communication where internal units must work together to maximize organizational outcomes" (Pellathy et al., 2019, p. 85). For this study, we adopted the latest definition by Pellathy et al. (2019) since they break down the primary three constructs mentioned above that identified CFI processes. They also make a clear differentiation among the dimensions and attributes of each construct.

Cross-Functional Integration

In organizational management research, integration typically refers to various practices to integrate efforts and cooperation through cross-functional teams (Ettlie & Reza, 1992; Swink & Nair, 2006; Swink et al., 2007; Gattiker & Goodhue, 2005). As mentioned earlier, previous research focused on the dyadic level of analysis between two departments. There is no indication; however, that integration was achieved (Gerwin &

Barrowman, 2002). According to Turkulainen & Ketokivi (2012), using cross-functional teams may not automatically obtain a state of organizational integration (Turkulainen & Ketokivi, 2012).

There are quite a few definitions notable for clarity and the precise nature of the various concepts related to cross-functionality. Pellathy et al. (2019) definition mentioned in the previous section incorporates collaboration, coordination, and communication as ongoing processes working together (Pellathy et al., 2019). Early scholars have suggested an approach for CFI separated as formal and informal initiatives to generate cooperation between departments and sub-units (Kahn, 1996; Sabath & Whipple 2004; DeLuca & Atuahene-Gima 2007). However, this has been an ongoing process as technology improves and processes increase. There is a need for more focus in arriving at a successful cross-functional initiative to achieve integration.

Due to the variations of CFI definition and measures, Pellathy et al. (2019) developed a mid-range CFI construct representing three foundational notions of integration concept within organization literature. Leenders & Wierenga (2002) conceptualized integration as "the degree to which there is communication, collaboration, and cooperative relationships among the functional units" (Leenders & Wierenga, 2002, p. 306). These foundational notions provide a solid theoretical background and encompass the three fundamental dimensions: collaboration of goals, coordination of activities, and knowledge communication (Pellathy et al., 2019). The following sections look at the three CFI dimensions for this study (collaboration, coordination, and communication).

Literature on CFI suggests that collaboration establishes common goals and work together to achieve those goals (Stank, Keller, & Daugherty, 2001; Ellinger, Keller, & Hansen, 2006; Oliver & Watson, 2011; Hausman, Montgomery, & Roth, 2002; Pagell, 2004). “Cross-functional collaboration is an ongoing process in which the different internal functions that manage a company’s processes establish common goals and objectives and work together to achieve them” (Pellathy et al., 2019, p. 85). The goal of the group must be important. However, group collaboration of different skill sets can be challenging as individuals focus on their own department’s goals. Some individuals may compromise the shared vision of the group.

Research has also emphasized the cross-functional coordination of CFI, linking internally performed activities into a seamless process to support business requirements. Coordination requires functional managers to adopt a process perspective (Pellathy et al., 2019) to achieve its overall objective rather than within its operational areas (Oliver & Watson, 2011).

Research has also conceptualized cross-functional communication as a means of information exchange, information sharing, and information processing (Flynn, Huo, & Zhao, 2010; Bretel, Heinemann, Engelen, & Neubauer, 2011; Song & Montoya-Weiss, 2001; Schoenherr & Swink, 2012). Myers & Myers (1982) originally defined organizational communication as "the central binding force that permits coordination among people and thus allows for organized behavior" (Myers & Myers, 1982, p. 5). Therefore, understanding CFI communication deals with the support of the exchange of information.

Theories used in CFI

Cross-functional studies have included many theories, as indicated by Jeske & Calvard (2020). Based on the literature, researchers have applied a range of approaches from social independence theory (Deutsch, 1949), cooperative model of knowledge sharing (Loebecke, VanFenema & Powell, 1999), motivation-ability-opportunity (MAO) framework (Maclnnis, Moorman, & Jaworski, 1991), configuration theory (Ordanini, Parasuraman, & Rubera, 2014), competing values framework for corporate communication (Cameron, Quinn, Degraff, & Thakor, 2006), and disconfirmation theory by (Oliver 1980; 2010). Other known approaches include Galbraith (1974). organizational information processing theory applied by (Cuijpers, Guenter, & Hussinger, 2011; Engelen, Brettel & Wiest, 2012; and Rosado Feger, 2014), as well as Pferre & Salancik (1978) resource dependency theory (Jeske & Calvard, 2020).

For this study, we applied the organizational information processing theory (IPT). Even though known approaches are used in CFI, there has not been an explicit agreement regarding the dominant view to use (Jeske & Calvard, 2020). Swink & Schoenherr (2015), in their study on CFI and process, efficiently found significant implications for applying IPT to explain internal integration's impact. According to Oliver & Watson (2011), the quality of information and engagement based on how data is processed is vital to successful cross-functional communication. These are characteristics of the IPT approach and one of the dimensions of this study's variables mentioned by Pellathy et al. (2019). CFI and sharing of information in team meetings can help departments learn about other functional unit characteristics and reduce biases for all involved (Enz, Schwieterman, & Lambert, 2019; Le Meunier-Fitzbugh & Massey, 2019).

Organizational Structure

Ghani, Jayabalan, & Sugumar (2002) and Robbins (2012) define the organizational structure (OS) as formal distribution of work rules and administrative mechanisms for controlling and integrating activities (Ghani et al., 2002; Robbins, 2012). OS is a set of authority hierarchies for coordination between departments and communication channels based on the organizational chart lines (Mintzberg, 1996; Daft, 2010). Therefore, work transfers between departments can be accomplished using hierarchical coordination implied by the OS. For this reason, I believe the OS will affect work transfer in the business processes.

An increasing amount of literature on organizational design economics investigates OS, such as delegation, hierarchies, and interactional processes. Ozbas (2005); Harris & Raviv (2002) investigated the effects of a complete delegation process. This work builds upon Crawford & Sobel's (1982) strategic communication model. Delegating some of the work processes may contribute to a smoother flow based on the environment. Strauss (1988) stated that interactional functions are essential to the operation of these work processes in his work on the interaction of processes. For instance, if resources are needed, there may be negotiation for funds and manipulation or coercion to obtain the most skilled workforce. Sroufe (2017) broadly analyzes different organization processes and structures in a multi-period setting, including reputation and internal competition to sustain change. Van Looy & Shafagatova (2016) conducted a structured literature review on process performance measurement and made a list of process-related indicators that managers could refer to regularly. All this research emphasized the organization's structure as a vital component.

Finally, Bai et al. (2017), in their study on OS and CFI, used the exact definition of OS as stated by Ghani et al. (2002) and continued to break down OS into two main areas: mechanical and organic. They defined mechanical OS (bureaucratic) as having a strict control level on specialized work with procedures, norms, and standards. Organic OS is defined as adaptive with no permanently fixed position or boundaries (Bai et al., 2017). Their finding concluded that mechanical organization has a significant negative correlation on performance, and organic organizations have a significant positive correlation on performance. This research will utilize OS in the study to support the fact that OS has a moderating effect on CFI and organizational performance.

Cross-Functional Teams

Cross-functionality at the team level may be subject to having a variety of integration mechanisms in place (Le Muenier-Fitzbugh & Massey, 2019; Rosado Feger, 2014). According to Lee (2020), when organizations promote collaborations across functional units, hidden costs are based on norms, cultures, and work in each department. So, integration depends on team boundary spanning activities and the high levels of team integration and relationships. Several authors have mentioned the importance of establishing effective cross-functional relationships to lead processes and manage boundaries between functional areas (Piercy & Ellinger, 2015; Le Meunier-Fitzhugh & Massey, 2019; Stahle, Ahola, & Martinsuo, 2019). In the work of Le Meunier-Fitzhugh & Massery (2019) and Stipp, Pimenta, & Jugend (2018), they stated that cross-functional teams need top management support, trust, and inter-functional meetings along a clear communication line. They also need help with the attitudes and behaviors of team members to make the team work more effectively.

The organization's size may also be a factor as smaller organizations might achieve CFI more effectively than larger ones. They may have more flexible structures (Rowe, Amrani, Bidan, Marciniak, & Geffroy-Maronnat, 2005), and according to Lee (2020), CFI may also depend on the section or organizational characteristics. Regulatory processes may need to adopt additional cross-functional roles (Lohmann & Zur Muehlen, 2019). If units are geographically separated, this can be negative for CFI efforts because of a broader barrier to communication and distance. Cross-functional interaction and team collaboration are vital in companies closely connected with a greater sense of unity (Coradi, Heizen, & Boutellier, 2015; Engelen et al., 2012).

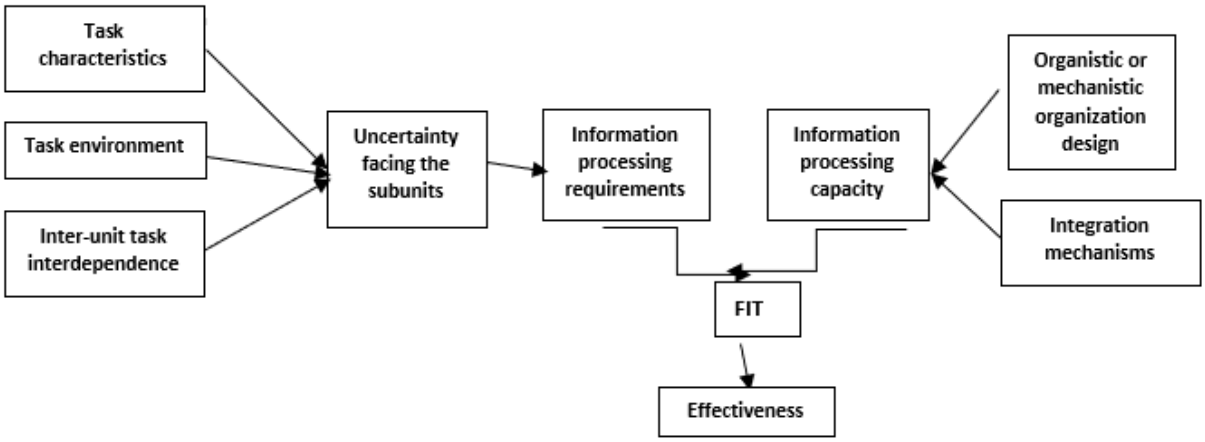
Conclusion

CFI problems in organizations are a fact in today's workplace. People and resources must coordinate and collaborate to accomplish the organization's mission. An increasing reliance on communication, the OS, and the prominence of multi-national companies have increased the need for managers, employees, and departments to work together in a cross-functional manner to deal with the challenges they face daily (Turkulainen, & Ketokivi, 2012; Hietajärvi et al., 2017). The literature reviewed suggested that CFI is essential, and collaboration, coordination, and communication are the most common processes. Also, OS will play a vital role in this relationship between CFI and performance.

III. THEORETICAL BACKGROUND

Information Processing Theory and CFI

For this research, we approached integration as an information processing phenomenon. This study's information processing approach looks at how organizations process information and the complexities that may affect an achieved CFI. Information processing theory is one tool used to measure the organizational work process. Multiple researchers have successfully applied this theory (Mani, Barua, & Whinston, 2010; Flynn & Flynn 1999; Graupner, Schewer, & Maedche 2015) as a foundation to conceptualize organizational process differences. For example, Mani et al. (2010) built upon the firm's information processing view that performance heterogeneity throughout business process exchanges is a function of how information capabilities are designed to fit the exchange's specific information requirements. They do this by comparing the performance effects of the fit between information requirements and capabilities. Results showed that relationships must be designed and managed for maximum performance gains by proper processing of information. Graupner et al. (2016) also build upon the information processing approach by applying a framework that determines the best-suited level of process visibility in the financial sector. A better understanding of how companies may choose how and where to establish process visibility was the result. This theory explains the reason various tasks require different management approaches. Figure 1 illustrates the components of this theory.



(Figure 1: Tushman and Nadler's (1978) Information Processing Framework)

IPT views organizations as bodies that effectively collect, interpret, and coordinate information. Based on Tushman & Nadler's (1978) information processing framework, different organizations face different obligations for information processing dependent on the task, task environment, and inter-unit task interdependence. In addressing the integration performance relationship, effectiveness means a fit between information processing requirements and the capacity to process this information (Turkulainen, 2008). The ability to process information in a company depends on its overall OS. This framework includes the notion that integration mechanisms are not equally crucial for all organizations. They may differ in terms of requirements for information processing.

Drawing on this IPT approach, we develop a conceptual model for this study using Tushmann & Nadler's (1978) framework. The IPT provides a valuable lens to

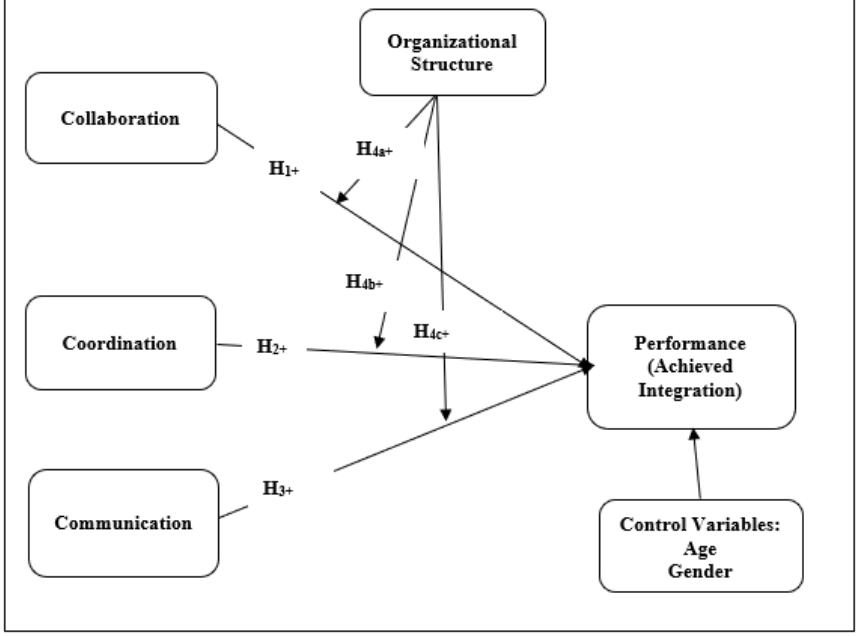
investigate the link between CFI and performance (organizational achieved integration). The theory explains the reason various tasks require different management approaches. Organizations need internal information processing capabilities to understand information collected externally (Shoenherr & Swink 2012). Divisional OS can create uncertainties, while integrative OS clarifies interdependences and builds information processing capabilities (Tushmann & Nadler, 1978). Figure 1 illustrates the components of this theory.

IV. RESEARCH MODEL AND HYPOTHESES

Research Model

Based on IPT, we proposed the research model. Cross-functional collaboration, coordination, and communication processes are complementary factors whose joint efforts contribute to CFI and performance success. Figure 2 shows the research model outlining CFI constructs and the impact on performance. With the OS as an essential function, the model also proposes that the OS serves as a crucial moderating construct in CFI paths to successful business performance. The model guides the hypotheses developed in the next section.

Figure 2: Measurement Model outlining the Effects of CFI on Performance



Hypotheses Development

Collaboration is about integrating goals. Cross-functional collaboration is the extent to which a firm work-processes or group of individuals involved in collaborative tasks are working together for a common goal (Gardner, 2015). It is the degree of cooperation, representation, and contribution of functional units (such as marketing, R & D, etc.) to achieving the team's or the organization's goal (Kahn, 1996; Li & Calantone, 1998). Cross-functional collaboration ensures that functional capabilities integrate well to provide product development (Griffin & Hauser 1996; Luo, Stotegraff & Pan 2006).

CFI literature indicates that cross-functional collaboration has two core elements: establishing common goals and working together to achieve them (Pellathy et al., 2019). Setting common goals required functional units to agree on a shared understanding of group objectives and the role each function plays in achieving those objectives (Stank et

al., 2001; Ellinger et al., 2006). The literature also implies an ongoing evaluation process and adjusting common goals to ensure mutual alignment is maintained (Oliver & Watson, 2011).

In addition to establishing a common goal, the collaborative activity involves working in unity to accomplish those goals (Hausman et al., 2002; Pagell 2004). Working together would require that the different functional units consider any unique constraints faced by other areas and share the resources necessary to overcome those constraints (Barratt, 2004). To achieve collaboration, some level of cooperation is required. Researchers have used this term to characterize CFI (Song et al., 1997; Calantone, Droge, & Vickery, 2002; Wong & Boon, 2008). According to Pellathy et al. (2019), cooperation refers to prioritizing individual and group goals. Collaboration establishes those goals and actively supports others in accomplishing them (Ellinger et al., 2006).

"IPT offers a theoretical base for cross-functional collaboration to predict organizational performance through increase resource dependency among functional units" (Swink & Shoenherr, 2015, p. 70). Therefore, there is a great need for improved information processing capabilities to coordinate knowledge. With this increase in knowledge sharing, inter-dependences and coordination among functional units also increase (Szalavetz, 2018). The increased collaboration represents an "essential strategic contingency for creating coordinating mechanisms" (Galbraith 1973; Kumar & Seth 1998, p 581). According to Kahn & Mentzer (1998), collaborative activities reflect different functional units' willingness to cooperate, but managers need mechanisms to take action (Kahn & Mentzer, 1998).

Prior research shows that the impact of collaboration on business performance is through a complex information processing process. Research has found that greater collaboration between functional units such as sales & marketing and manufacturing have significant benefits on performance, while the effect may vary based on the type of business or firm. (Frosh & Sullivan, 2006; Le Muenier-Fitzhugh & Piercy, 2007; Sanders & Premus, 2005; Hansen & Nohria, 2004). Le Muenier-Fitzhugh & Piercy (2007) examined the importance of collaboration and found a direct and positive relationship between the functional units' collaboration and performance. They pointed out that effective collaboration reduces interdepartmental conflict and improves communication and learning environment, impacting organizational performance. Also, Frosh & Sullivan (2006) conducted two studies on whether collaboration directly impacts performance. They broke down the effectiveness of collaboration among functional units such as HR, R&D, Sales, Marketing, Investor Relations, and PR and how each area's effective collaborative activities impacted its performance. They found that collaboration impacted every aspect of business performance (Frosh & Sullivan, 2006). Similarly, Sanders & Premus (2005) studied cross-functional collaboration and firm performance and found that collaboration is positively associated with firm performance.

Collaboration is a process of inter-department decision-making. It involves shared decisions and collective responsibility for outcomes. For example, Stank et al. (2001) looked at collaboration with supply chain and logistic units and found that internal collaboration among units improves performance. Based on these studies, we argue that the more there is a collaboration of group goals and mutual alignment, the higher the

degree to which CFI is achieved. Therefore, this research proposes the following hypotheses:

H_1: Cross-functional collaboration has a positive effect on performance

Organizational research views integration as coordinating functional units' activities (McCann & Galbraith 1981; Barki & Pinsonneault 2005). Coordination is having a mutual understanding of capabilities and aligning respective goals and actions (Bendoly et al., 2012). From this point of view, an organization becomes a system of interdependent functions. Each carries out a specific set of activities, such that the outputs from one functional process represent inputs for other operating activities (Thompson, 1967). Therefore, the main issue of CFI is managing interdependences across functional activities to enhance the overall flow of inputs and outputs of an entire process (Malone & Crowston, 1994). For this purpose, coordination mechanisms, such as rules, plans, schedules, and periodic reviews that regulate and synchronize functional operations, facilitate effective coordination (Thompson, 1967; Van de Ven, Delbecq, & Koenig, 1976; McCann & Galbraith, 1971).

The integration literature implies that coordination requires functional leaders to practice a process perspective focused on optimizing the entire flow of operational activities instead of carrying out individual functional areas work (Stadtler 2005; Chen et al., 2007; Handfield, Cousins, Lawson, & Petersen, 2015). Therefore, managers need to rectify conflicts in decision-making to ensure maximum efficiency regarding sequencing and timing of activities (Simatupand, Wright, & Sridharan, 2002; Lambert, Dastugue, & Croxton, 2005; Brettel et al., 2011).

Several researchers have studied the effects of cross-functional coordination on business or firm performance and have suggested that there is a positive impact of coordination on performance (Le Meunier-Fitzhugh & Massey, 2019; Nguyen, Ngo, Bucic & Phong, 2018; Handfield et al., 2015; Foerst, Hartmann, Wynstra, & Moser, 2013; Carr, Kaynak & Muthusamy, 2008). Carr et al. (2008) conducted a study with 231 firms on coordination capabilities between functional areas, including operations. They looked at numerous relationships among these units concerning cross-functional coordination and performance. Their research showed that firms could benefit from effective cross-functional coordination among operations, marketing, purchasing, and engineering. Another study conducted by Foerstl et al. (2013) looked at functional coordination and firm performance and found a positive effect of coordination on performance. Nguyen et al. (2018) experimented with 224 large firms in a transition economy to determine the relationship of various coordinating mechanisms, knowledge sharing, and firm performance. They concluded that cross-functional coordination, as well as knowledge sharing, helps a firm to improve its performance. Significant improvement in cross-functional coordination mechanisms among several functional units can help facilitate performance levels. Le Muenier-Fitzhugh et al. (2019) revealed that cross-functional coordination was different among functional units and positively influenced business performance. They further suggested that creating cross-functional teams can reduce conflict and increase coordination, ultimately improving business performance (Le Muenier-Fitzhugh et al., 2019).

Prior research further shows that cross-functional coordination in marketing, R&D, operations, and supply chain processes significantly increases the integration

process's performance. Atuahene-Gima & Evangelista (2000) found that more effective CFI can speed up time and enhance the collaborating and coordinating degree of a product line, thus increasing product development team performance.

According to Lambert (2004), successful coordination of business processes across members determines an enterprise's overall performance success (Lambert, 2004). In other research, evidence showed that increased operational and organizational performance often occurs in firms where two or more procedures are well coordinated (Narasimhan & Kim, 2001; Pagell et al., 2000). Based on these studies, we argue that coordination has a positive effect on a firm's ability to successfully achieve integration performance. Therefore, this research proposes the following hypotheses:

H2: Cross-functional coordination has a positive effect on performance.

Communication is about integrating knowledge across organizational units. This knowledge represents the most fundamental corporate resource. It allows organizations to overcome value creation operational problems. However, the knowledge required to tackle specific issues is frequently lacking or spread across specified groups or individuals (Grant 1996). Thus, most organization's core tasks are creating, sharing, and combining knowledge so that relevant and timely information is exchanged effectively (Pellathy et al., 2019; Tushman & Nadler, 1978; Nonaka, 1994). From this view, integration effectively becomes a communication process that flows back and forth across functional areas (Pellathy et al., 2019).

Research has stressed an understanding of CFI as a communication process focused on information exchange needed to support operations (Calantone et al., 2002; Sanders & Premus, 2002; Williams et al., 2013). Research in this area operationalized

cross-functional communication as information exchange (Narasimhan & Kim 2002; Flynn et al. 2010; Brettel et al. 2011), information sharing (Song & Montoya-Weiss 2001), information processing (Schoenherr & Swink 2012), and interaction (Kahn & Mentzer 1996). This literature's central theme is the critical role of cross-functional communication in joint decision-making and action within the organization (Barratt & Barratt 2011).

Cross-functional communication of functional areas involves sending and interpreting information through formal and informal channels (Andrea, Arnaldo, & Romano, 2011). It requires sharing information kept in one functional area but applicable to other functions (Mollenkopf, Gibson, & Ozanne, 2000; Sherman, Berkowitz, & Souder, 2005). Communication, therefore, implies that departmental units have a clear understanding of different functional areas' information needs (Calantone et al., 2002). Communication also requires that the receiver understands the information they are receiving (Dougherty, 1992). Functions are expected to work together to ensure that information is communicated, understood, and supports a collective response to the business environment (Fugate, Stank, & Mentzer, 2009; Ellegaard & Koch, 2012).

The effect of communication on performance aligns with the success of cross-functional teams working together. Cross-functional teams usually come from different departments and units within an organization and may even be geographically dispersed. Each person has their respective ideas and communication style that sometimes differs. To achieve a high level of performance, they must find ways to communicate frequently. Patrashkova-Volzdoska, McComb, Green, & Compton (2003) explored the relationship between cross-functional teams and performance. They conducted an exploratory study

with 60 cross-functional project teams and concluded that high team communication levels could improve performance, and low levels of team communication can impede performance. Barczak, Siltan & Hulink (2007) study finds that a low frequency of communication among R & D, marketing, and manufacturing departments has a high association with product development failure.

In contrast, close communication and information sharing among team members contributed to the success of product development. Mohammed, Stankosky & Murray (2004) proposed a systematic approach, applying the principles of knowledge sharing and cross-functional team in ways that will directly enhance knowledge flow and significantly improve organizational performance. Based on these discussions, this research proposes the following hypotheses:

H_3: Cross-functional communication has a positive effect on performance.

Moderating Effect of Organizational Structure

OS refers to the formal arrangement of work roles in a company that involves managing and integrating inter-organizational activities. It is a means to achieve business goals (Bai, Feng, & Feng, 2017). Theorists have defined OS in several ways. Donaldson (1996) described OS as "the recurrent set of relationships between organizations members" (Donaldson, 1996, p. 57). It involves attitudes and communication among its members that can be formal or informal relationships (Clegg, Hardy, & Nord 1996). Miner (2002) defined OS as capturing centralization of authority, complexity, formalization, and integration (Miner, 2002). Griffin & Moorhead (2011) claimed that OS represents the company's reporting of tasks and other relationships within the organization. According to Ambrose & Schminke (2003), the most noticeable

description of OS differences is based not only on formal and informal but also on mechanic and organic structures. Mechanic OS is rigid and tight. Power is centralized, and there is a hierarchical communication channel with formal rules and regulations. On the other hand, organic OS is more informal, flexible, loose, decentralized, and communication is more open and adaptable to help employees accomplish their goals (Ambrose & Schminke, 2003; Lawrence & Lorsch, 1967). From this point forward, OS refers to Mechanical OS.

Mechanical OS is of interest for this research because of its complexity, which is still being used in many organizations today. These organizations also look for ways to improve their CFI within their current structure while adhering to hierarchical communication, regulations, and control. Some researchers have argued that mechanical OS is tight and rigid (Abdullah & Siam, 2014; Ambrose & Schminke, 2003). Still, others have said that it is necessary to facilitate cross-functionality in a stable environment (Bai et al., 2017; Creed, Waddell, Cummings & Worley, 2019). Decision-making has a system formally in place that efficiently increases benefits and reduces costs in this structure (Bai et al., 2017). Creed, Waddell, Cummings & Worley (2019) stated that leaders could maximize their organization's potential long-term by ensuring they have a good understanding of the concepts of this kind of structure. This will further help managers to implement a better CFI system.

Collaboration and OS: Collaboration establishes group goals, proactively supports authors in achieving goals, and maintains mutual alignment. Because OS is categorized in several ways, including formal and informal, mechanic, and organic, these descriptions' characteristics can affect performance. For example, Abdullah & Siam

(2014) confirmed that OS could inhibit or promote performance depending on the relationships and workflows that influence productivity. They continued to say that these OS and reporting hierarchy affects performance management in goal-setting activities (Abdullah & Siam, 2014).

Coordination and OS: Coordination focuses on managing interdependencies and unified process control, jointly managing the flow of operational activities. Building a good OS is essential for employees to effectively manage these interdependencies and maintain a suitable control process to increase their performance levels. According to Bernd (2007), OS's structural dimension is a tool for integrating and coordinating. Managers should focus on addressing key elements when designing OS for effectively managing the flow of operational activities and performance (Daft, 2010; Bernd, 2007). Additionally, Carter & Pucker (2010) suggested a relationship between coordination, good OS, and organizational performance.

Communication and OS: Communication seeks to maintain the reciprocal flow of information, ensuring clarity of intent when sharing relevant information to support collective decision-making. According to Islam, Ahmed, Hasan & Ahmed (2011), OS consists of centralization, complexity, and formality, which involves rules, procedures, and instructions in writing. They stated that less formal OS usually leads to better or more excellent communication among the organization members. A more flexible OS helps lower the barriers during communication flow (Islam et al., 2011; Willem, Buelens, & Jonghe, 2007).

Because the OS serves as a framework and offers a boundary for managers in decision-making, Abumandila & Hassana (2016) argued that it impacts whether

information received by managers is of excellent quality. For example, individuals may not receive information on time in a mechanical organization because it must flow through a proper channel. The information's accuracy could also be affected and may get filtered down as it reaches its destination. Due to the nature of integration and collaboration processes in CFI, quality information, knowledge sharing, and coordination are vital. Access to such information is likely to be compromised. Formal or more structured mechanical organizations knowledge sharing may be limited (Abumandila & Hassana, 2016; Gonzalez-Cruz, Huguet-Roig, & Cruz-Ros, 2010).

Other research has indicated that OS interacts with various factors that influence organizational performance. Some of these factors include organizational size (Pugh, Hickson, Hinings & Turner, 1969), environmental change (Lawrence & Lorsch, 1967), organizational strategy (Chander, 1962), supply chain technology (Bai et al., 2017). Research has proved that OS affects organizational performance (Covin & Slevin, 1989; Jennings & Seaman, 1990; Ambrose & Schminke, 2003; Bai et al., (2017). Also, no organization is ideally organic or mechanic, and some display both. Thus, the OS provides a clear choice to consider in exploring moderating effect. Based on the above, this research proposes that it will affect the relationship when the OS is included in the relationship between CFI and performance. The nature of this effect can either strengthen, weaken, or change the direction of the relationship. Based on these discussions, the study proposed the following hypotheses:

H_{4a}: OS has a moderating effect on the relationship between collaboration and performance, such that high OS has a stronger effect on the relationship than low OS.

H_{4b}: OS has a moderating effect on the relationship between coordination and performance such that high OS has a stronger effect on the relationship than low OS.

H_{4c}: OS has a moderating effect on the relationship between communication and performance, such that high OS has a stronger effect on the relationship than low.

V. METHODOLOGY

Research Design

This study follows a quantitative cross-sectional survey approach to test the research model. A survey method was suitable to "capture the experiences and determine the meaning the participants hold about the problem" (Creswell, 2014 p. 186). Using surveys as a data collection method was more appropriate for this study as it enables a broader set of data collection from the individual unit of analysis. Since the technique helps explain individuals' attitudes about CFI, it is instrumental in describing a large population's characteristics. Our survey questions are closed-ended, where individuals select from a list of choices. It is also a popular research method because of the uniformity of responses and can be more easily processed (Babbie, 2015).

Variable Measurement

In order to maintain measurement validity and reliability, survey instruments were adopted from existing validated scales from literature with minimal modification for this

research study. Collaboration, coordination, and communication are three important reflective constructs for CFI. CFI was measured using scales items taken from Pellathy et al. (2019) and MaKenzie et al. (2011). According to the study from Pellathy et al. (2019), all CFI constructs were reflective and determined based on theoretical considerations (Pellathy et al., 2019; Jarvis et al., 2003).

Collaboration was measured with 7 items of the CFI scale adopted from Pellathy et al. (2019) and MaKenzie et al. (2011). The scale of collaboration includes; ***in my organization, different areas of the functional units work across functional boundaries to***… (A1) jointly establish the overarching goals that direct our individual functional activities, (A4) Ensure an open and transparent process for establishing common goals, (A5) Establish a regular process for reviewing joint functional units' goals, (A6) Support other functions in achieving common goals. Out of the 7 items, A2, A3, and A7 were dropped due to lower factor loadings. The items dropped were:

- (A2) Make sure there is joint agreement on functional unit goals.
- (A3) Engage constructively in debates about goals of the functional units.
- (A7) Adjust goals and objectives to reflect constraints faced by different functions.

Coordination was measured with 6 items from the CFI adopted from Pellathy et al. (2019) and MaKenzie et al. (2011). The scale of coordination includes; ***in my organization, different areas of the functional units work across functional boundaries to***… (B1) actively manage lead times across functions, (B2) ensure that functional activities are synchronized across the different areas, (B3) jointly manage interdependences across functional areas, (B6) make sure functional areas see themselves

as part of a larger overall process. Out of the 6 items, B4 and B5 were dropped due to lower factor loadings. The items dropped were:

- (B4) Make sure everyone is focused on process optimization rather than achieving separate functional goals.
- (B5) Make sure functional decisions do not conflict with each other.

Communication was measured with 6 items from the CFI scale adopted from Pellathy et al. (2019) and MaKenzie et al. (2011). The scale of communication includes**:** ***In my organization, different areas of the functional units work across functional boundaries to***… (C1) make sure relevant information gets to the right people in different functional area, (C3) make sure everyone understands what information needs to be communicated out to the different functional areas, (C5) make sure everyone understands how information is used in different functional areas, (C6) make sure those on the receiving end understands why they are getting the information they are receiving. Out of the 6 items, C2 and C4 were dropped due to lower factor loadings. The items dropped were:

- (C2) Keep key players in different functions informed about what is going on.
- (C4) Make sure the information that is being communicated is useful to those on the receiving end.

The dependent variable performance was measured using 6 items adopted from Kahn & Mentzer (1998) and Turkulainen & Ketokivi (2011) "achieved integration" scale to measure CFI performance. The performance scale includes ***evaluate your organization based on the following….*** (D1) the functions in our organization are well integrated, (D3) functional coordination works well in our organization, (D5) our

organization functions coordinate their activities, (D6) our organization functions work interactively with each other. Out of the 6 items, D2 and D4 were dropped due to lower factor loadings. The items dropped were:

- (D2) Problems between functions are solved easily in the organization.
- (D4) The functional units in our organization work well together.

The moderating variable OS was measured using 5 items from the study of Bai et al. (2017) adopted from Miller & Drogel (1996). OS scale includes ***evaluate your organization based on the following***….. (E1) the views of staff can be quickly transferred to business leaders, (E2) market information of product/services can be quickly feedback to the organization decision-making, (E3) our organization is able to break departmental boundaries to collaborate and respond to changes quickly, (E4) our organization can rapidly respond to market integration of resources required, (E5) our organization promotes team collaboration in order to enhance the ability to cope with change. The instruments were operationalized using reflective constructs. Adjustments were made to eliminate weaker loading variables using acceptable measures. All the construct items were measured by a 5-point Likert from "1-strongly disagree" to "5-strongly agree." Appendix B lists all construct items on the survey instrument.

The survey also includes demographic and other questions about the participants, including (a) age, (b) gender, (c) educational level, (d) industry employed in, (e) length of employment, (f) CFI functional area involved in, (g) company size, (h) occupation, and time spent on CFI activities. Table 1 shows more detailed information about the sample demographics.

Sampling, Participants, and Procedures

Pilot Study: An initial pilot study was conducted with a small group of executives and managers recruited from multiple functional units within their organizations and spread across a few states within the United States. An online survey that allows for quick responses was used. Twenty-one were recruited from the FIU DBA cohort, and five were recruited from business colleagues, resulted in a total of 26 fully completed survey responses. Among the 26 responses, 24 of them live and work in South Florida, and 2 live and work in other states.

One of the advantages of conducting a pilot study, also known as a feasibility study, was to do pre-testing of the research instrument (Baker, 1994). The informed pilot helped to gather data and guidance to complete the primary data collection. It provides advance indications of whether the proposed instruments are too complicated, inappropriate, and not worth the risk (De Vaus, 1993). Questions were adjusted, and the necessary changes were made based on results and comments from the pilot study. According to Van Teijlinger & Hundlet (2001, p. 4), "well-designed and well-conducted pilot studies can give insight about the best research process and sometimes the likely outcome." The survey hosed by Qualtrics was then refined based on the pilot results for the primary data collection described in the next section.

Main Study: The primary data collection utilizes participants from Amazon MTurk to reach a wide range of participants and industries. The study targets those who have an understanding and experience of CFI. In prior studies, Amazon MTurk has been used to gather valid data on the cross-functional phenomenon (Pellathy et al., 2019).

The survey reached 400 participants who consented to participate. To ensure data quality, we set up qualifying criteria to reduce dropout rates and any attempt to rush through the survey without paying attention. Eligible participants were required to be over 18, located within the United States, work in a company with multiple functional units, and daily duties must involve working with groups or part of a team. Of this total, 375 participants met the qualifying criteria and continued to complete the survey.

Due to the nature of the survey and the data collection method, we randomly inserted three attention-trap questions into the survey body. Of the 375 qualified responses, the first trap question eliminated 15 participants. The second trap question eliminated 22 participants. Thirteen (13) respondents were removed due to the fast completion rate of a minute or less. The average time taken to complete both the pilot and primary survey was approximately 8 minutes. The final number of valid and completed responses was 325, yielding a response rate of 81%.

As shown in Table 1, which illustrates the sample demographics information, the primary survey included a final sample of 325 participants with a gender breakdown of 215 (66%) male and 110 (34%) females. The average age was 44 years old. Overall, the sample represented many different industries. The largest category represented were from the information technology (IT) industry (28%) followed by manufacturing & construction (21.2%), banking & finance represented (10.5%), healthcare represented (10.2%), hospitality and tourism (8.3%), and food & Beverage (7.1%). The remaining 9.5% made up of other industries such as government and non-profit organizations.

Almost half the population (49.5%) or 161 persons indicated that they have been with their current organizations between 3 to 5 years. Also, 83 persons (25.5%) have

worked with their company for 1 to 2 years, 53 persons (16.3%) have worked with their company for 6 to 10 years, 21 persons (65%) have worked with their company for over 10 years, and 7 persons (2.2%) have worked with their company for less than 1 year.

Responses were obtained from individual employed in a range of positions, including operational executives (Director, Senior Manager, Executive - 17.8%), managers (operational managers, supervisors - 68%), support staff (line staff, clerical, auxiliary - 12%), and other positions (2.2%). This distribution indicates that many respondents (85.8%) held a supervisor position or higher, suggesting that they possess the relevant knowledge regarding the survey content.

The sample also shows that participants were from a diverse CFI background including Information Technology (24.6%), Marketing (17.5%), Manufacturing (16.6%), Customer Service (8.9%), Admin (8.6%), Human Resources (7.7%), R & D (7.4%), and Logistics & Transportation (6.2%). The average company size for participants was 500 employees and the average time spent on CFI duties was 59% of work hours. Table 1 shows the details of the sample demographics**.**

Table 1: Sample Demographics (N=325)					
Age	**n**	**%**	**Company Size**	**n**	**%**
18-24	13	4%	1-100	76	23.4%
25-34	151	46.5%	101-499	123	37.8%
35-44	92	28.3%	500-999	72	22.2%
45-54	48	14.8%	1000-4999	34	10.5%
55-64	17	5.2%	5000 and above	20	6.2%
Over 65	4	1.2%			
Industry	**n**	%	**Scope of Duties**	**n**	%
Healthcare	33	10.2%	Director, Snr. Manager,	58	17.8%
Hospitality/tourism	27	8.3%	Exec.		
Food & Beverage	23	7.1%	Manager, Asst, supervisor	221	68%
Education	28	8.6%	Line, clerical, auxiliary	39	12%
Manufacturing/Construction	69	21.2%	Other responsibility	7	2.2%
Information Technology	91	28%			
Banking/finance/Insurance	34	10.5%			
Government/Non-profit	8	2.5			
Other	12	7			
Length of employment	**n**	%	**Time spent on CFI**	**N**	%
Less than I year	7	2.2%	0-19%	18	5.5%
1 to 2 years	83	25.5%	20-39%	113	34.8%
3 to 5 years	161	49.5%	40-59%	141	43.4%
6 to 10 years	53	16.3%	60-79%	45	13.8%
10 years or more	21	6.5%	80-100%	8	2.8%
CFI functional area	**n**	%	**Gender**	**n**	**%**
Research & Development	24	7.4%	Male	215	66
Manufacturing/Operations	54	16.6%	Female	110	34
Logistics & Transportation	20	6.2%			
Human Resources	25	7.7%			
Customer Service	29	8.9%			
Marketing	57	17.5%			
Admin (finance, acct, legal)	28	8.6%			
Information Technology	80	24.6%			
Other	8	2.5%			

VI. DATA ANALYSIS AND RESULTS

Data Analysis

Data analysis was conducted using SPSS 26 for statistical analysis and Smart PLS 3.0 for partial least square structural equation modeling (PLS-SEM). PLS-SEM is a component-based structural equation modeling approach. This was to analyze the validity and reliability of the measurement model and test the respective hypotheses, including the moderating interaction of OS. Using Smart PLS was a more suitable approach to handling interaction relationships (Becker, Ringle & Sarstedt, 2018; Chin, Marcolin & Newsted, 2003).

Descriptive Statistics

Descriptive statistics for all variables were generated in SPSS and shown in Table 2, including mean, standard deviation (SD), skewness, and kurtosis. Descriptive statistics for collaboration revealed an overall mean score of 4.09 - SD of 0.694. The skewness of -1.01 and kurtosis of 3.103. This showed a positive perception of collaboration amongst the participants. Descriptive statistics for coordination revealed an overall mean score of 4.06 - SD of 0.668. The skewness of -0.863 and kurtosis of 2.561. This also showed a positive perception amongst the participants. Descriptive statistics for communication revealed an overall mean score of 4.10 – SD of 0.667. The skewness of -0.856 and kurtosis of 1.696. This shows a positive perception amongst the participants. Descriptive statistics for performance revealed an overall mean score of 4.00 – SD of 0.649. Skewness 0f -1.048 and kurtosis of 2.471. This shows a positive perception amongst the participants. Finally, descriptive statistics for OS revealed an overall mean score of 3.026

- SD of 1.098. The skewness of 0.002 and kurtosis of -1.197. This shows a positive perception amongst the participants.

Skewness and Kurtosis: Skewness suggests the amount and direction of the skew, and Kurtosis indicates how tall, and sharp the central peak is. Both are necessary for testing for normality. Bulmer (1979) suggests the rule of thumb that if skewness is < -3 or > 3, the distribution is highly skewed. Based on the descriptive statistics, collaboration, coordination, communication, and performance were all skewed to the left, and OS skewed to the right. However, the skewness values were much less than 3, indicating the skewness was not a concern. In terms of kurtosis, collaboration, coordination, communication, and performance all had positive kurtosis, and OS has a negative kurtosis. However, the kurtosis values were 3 or less, indicating that the kurtosis was not a concern. Table 2 illustrates the components of the descriptive statistics with skewness and kurtosis.

Table 2: Descriptive Statistics (N=325)

Variables	Minimum	Maximum	Mean	Std. Dev.	Skewness	Kurtosis
Age	1	8	2.760	1.090	1.461	3.842
Gndr	1	2	1.340	0.470	0.686	-1.539
Collab	1	5	4.089	0.695	-1.010	3.103
Coor	1	5	4.065	0.668	-0.863	2.561
Comm	1	5	4.102	0.667	-0.856	1.696
Perf	1	5	4.008	0.650	-1.048	2.471
OS	1	5	3.026	1.099	0.002	-1.197

Normality was also evaluated using Q-Q scatterplot (Bates, Machler, Bolker, & Walker, 2014; Field, 2013; DeCarlo, 1997). The Q-Q scatterplot compares the distribution of the residuals with a normal distribution (follows a bell curve). In the Q-Q

scatterplot, the solid line represents the theoretical quantile of a normal distribution. Normality is assumed if the points form a straight line. The normality curves are presented in Appendix C and the Q-Q scatterplot for normality is presented in Appendix D1 and D2.

Measurement Model

The measurement quality of all scales is evaluated for reliability, discriminant validity, and convergent validity. We assessed the multi-item scales' reliability and validity using approaches recommended by Anderson & Gerbing (1988). The measurement model was tested with a CFA using Smart PLS 3.0. "Convergent validity is supported when the factor loadings prove that the measurement items significantly load to their respective latent variables" (Anderson & Gerbing, 1987; Chen et al., 2017, p. 12). Gefen & Straub (2005) also pointed out that items must have loadings of 0.6 or higher for convergent validity to be established. Most items loaded favorable to their respective constructs, and the loadings were significant and greater than 0.6. Items with loadings below 0.6 were subsequently dropped for better significant loadings. The remaining items are listed in Table 3, which shows the loading of all variables, and subsequently used to perform the final data analysis.

"Discriminant validity of the measures is established by the average variance extracted (AVE) square root of the construct being greater than the correspondent correlations" (Swink & Schoenherr (2015, p75) and that the items correctly load to the corresponding latent construct. All the items loaded favorably to their respective latent constructs. The correlation shows that the inter-construct correlation among the latent variables is below the AVE's square root. Satisfactory Cronbach's alpha and CR

maintained reliability. All CR values were 0.8 or higher, which is above the recommended 0.7 thresholds and the AVEs were all above 0.5, also within the recommended threshold (Bagozzi & Wi, 1988; Swink & Schoenherr, 2015). Table 3 – measurement loadings and Table 4 – discriminant validity, show the details.

Table 3: Measurement Loadings, Composite Reliability (CR), Average Variance Extracted (AVE)

	Items	1	2	3	4	5
1. Collab	Collab_1	**0.780**				
CR = 0.87	Collab_4	**0.822**				
AVE = 0.63	Collab_5	**0.825**				
	Collab_6	**0.770**				
2. Comm	Comm_1		**0.778**			
CR = 0.85	Comm_3		**0.818**			
AVE = 0.60	Comm_5		**0.779**			
	Comm_6		**0.731**			
3. Coord	Coord_1			**0.783**		
CR = 0.80	Coord_2			**0.758**		
AVE = 0.62	Coord_3			**0.794**		
	Coord_6			**0.805**		
4. OS	OS_2				**0.935**	
CR = 0.93	OS_4				**0.700**	
AVE = 0.73	OS_5				**0.680**	
	OS_6				**0.830**	
5. Perf	Perf_1					**0.816**
CR = 0.84	Perf_3					**0.760**
AVE = 0.60	Perf_5					**0.752**
	Perf_6					**0.715**

Table 4: Discriminant Validity of Measurement Model						
		Collab	Comm	Coord	OS	Perf
1	Collab	**0.793**				
2	Comm	0.678	**0.766**			
3	Coord	0.775	0.710	**0.777**		
4	OS	0.266	0.269	0.225	**0.855**	
5	Perf	0.709	0.754	0.749	0.236	**0.754**

Structural Model and Hypotheses Tests

Given the measurement model's valid assessment, the next step involves the structural model analysis to test the hypothesized relationships. The structural model resembles a path analysis and specifies regression models for the factors derived in the measurement model causal relationships among the latent variables (Agresti, 2018). Smart PLS 3.0 was used for the structural equation modeling analysis (SEM). Each hypothesis was assessed by reviewing the direction, significance, and magnitude of each sigma coefficient. A 5000-sample bootstrapping was done, and the t-statistics generated were used to determine the significance level.

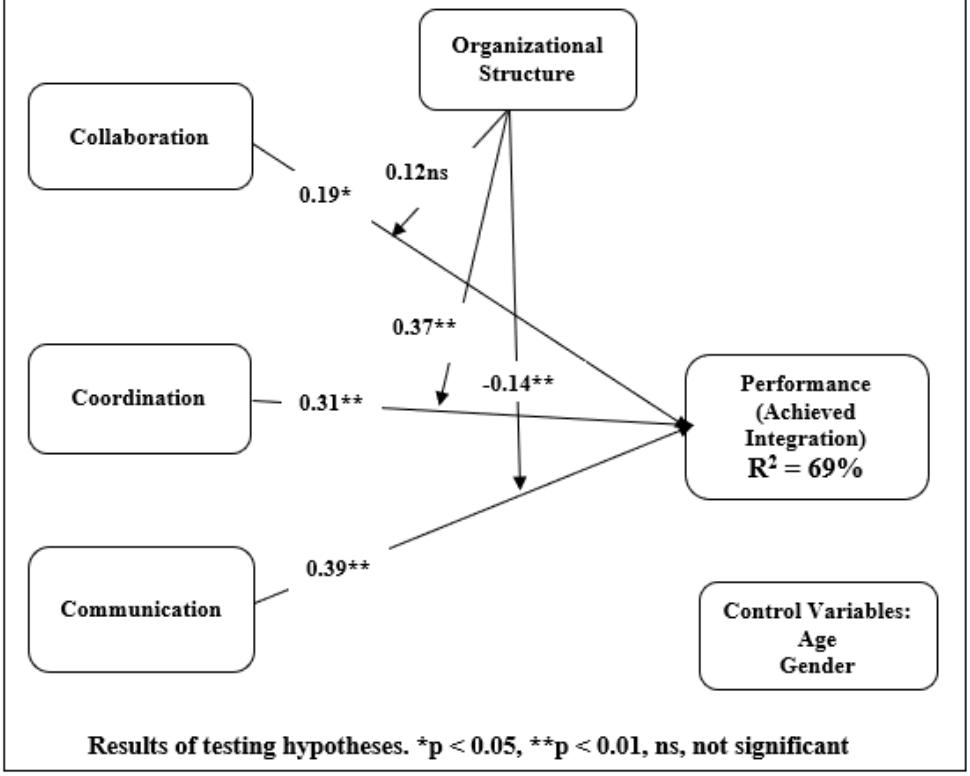
The hypotheses testing results, including the significance levels in the model, are shown in Table 5 summary of results, and illustrated in Figure 3 model with path coefficient. The R^2 value is also provided. Overall, the model explains 69% of the variation in performance.

Table 5
Summary of Results showing p-value.

Hypotheses	Predictors	β	t-value	p-value	Result
H1	Collab -> Perf	0.14	2.505	0.012*	Supported
H2	Coord -> Perf	0.358	5.056	0.000**	Supported
H3	Comm -> Perf	0.411	6.952	0.000**	Supported
H4a	OS*COLLAB -> Perf	0.04	0.594	0.553ns	Not Supported
H4b	OS*COORD -> Perf	0.177	2.601	0.009**	Supported
H4c	OS*COMM -> Perf	-0.169	2.651	0.008**	Not Supported

***p < 0.05, **p < 0.01, ns, not significant**

Figure 3: Measurement Model with Path Coefficient



Results of testing hypotheses. *p < 0.05, **p < 0.01, ns, not significant

Hypothesis Tests

Independent Variables: $\mathbf{H}_1$ examination of the direct relationship between cross-functional collaboration and performance was supported ($\beta = 0.140$, $t = 2.505$; $p < 0.05$). $\mathbf{H}_2$ examination of the direct relationship between cross-functional coordination was supported ($\beta = 0.358$, $t = 5.056$, and $p < 0.01$). $\mathbf{H}_3$ examination of the relationship between cross-functional communication and performance was supported ($\beta = 0.411$, $t = 6.952$, and $p < 0.01$). Table 5 illustrates the summary of these results.

Control Variables: A multigroup Analysis (MGA) was conducted along with 5000-bootstrapping for age and gender to see if there were any group-specific differences. We checked for both equal and unequal variances across the groups. For gender, the results from the bootstrap for female vs male showed significance for the complete group. However, both the Parametric Test (which assumes equal variance across groups) and Welch-Satterthwait Test (which assumes unequal variance across groups) showed that there was no significant difference between female versus male. Appendix E1, E2, E3, and E4 illustrate the results of the MGA for gender.

For age, the younger age group was 18-34 and the older age group was over 34 years. The results from the bootstrap showed significance for the complete group. However, both Parametric and Welch-Satterthwait tests showed no significant difference between younger vs. older group. Appendix F1, F2, F3, and F4 illustrate the results of the MGA for age. The results confirmed that neither age group nor gender specific had any effect on the relationship between CFI and performance.

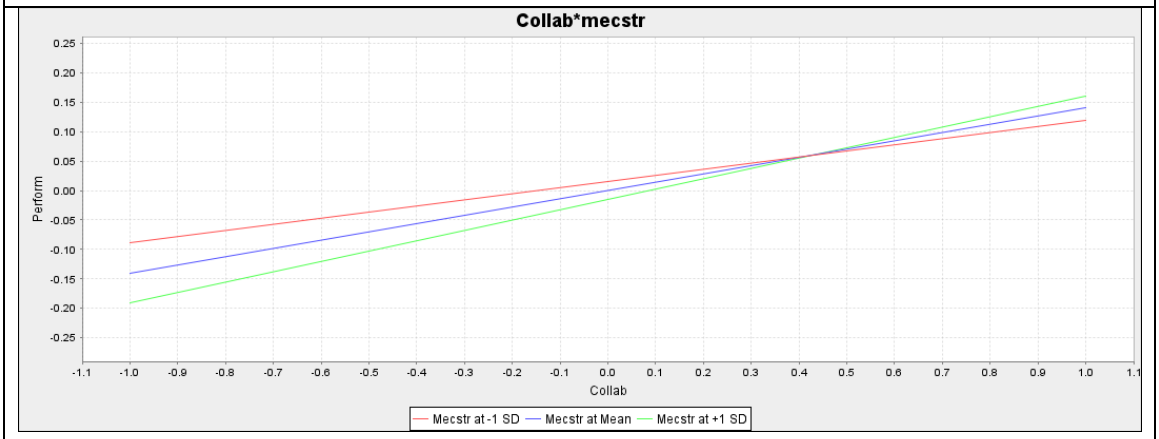
Moderating Variable: Finally, we tested the moderation of mechanical OS on the relationship between CFI and performance. The results revealed that the moderation

of OS was significant with coordination and communication. In detail, $\mathbf{H}_{4b}$ was supported with a p-value less than 0.01 ($\beta = 0.177$, $t = 2.601$, $p = 0.009$). $\mathbf{H}_{4c}$ was also supported with a p-value less than 0.01 ($\beta = -0.169$, $t = 2.651$, $p = 0.008$). However, the moderation was not significant with collaboration. Thus, $\mathbf{H}_{4a}$ was not supported, with a p-value that was greater than 0.05 ($\beta = 0.040$, $t = 0.594$, $p = 0.553$). Figure 4, diagrams A, B, and C show the interaction effects. The green line represents a high OS above the mean (+1 SD above the mean) from the diagrams. The blue line represents a low OS below the mean (-1 SD below the mean). The red line represents the mean of OS.

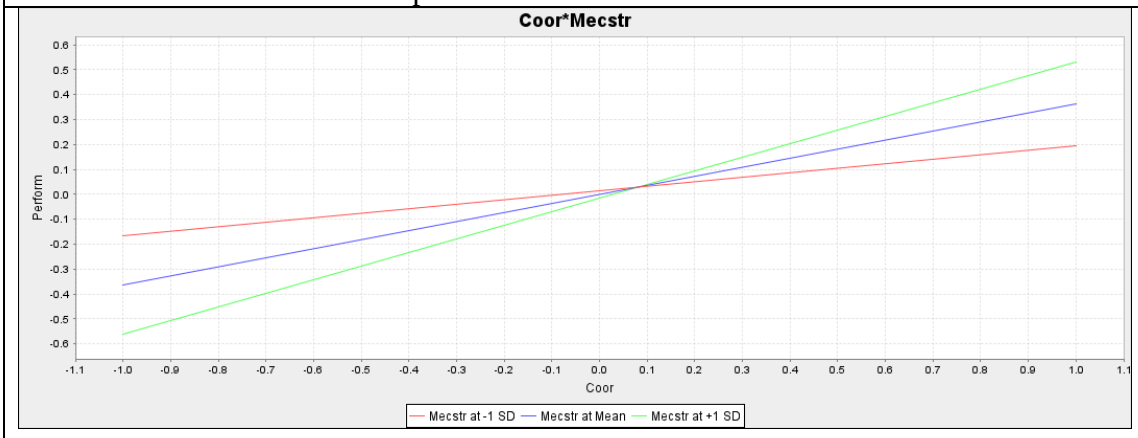
All three interactions are dis-ordinal, which means that the interaction effect occurs within the border at the cross-over point, as shown in interaction diagrams A, B, and C in Figure 4. In diagram A, the slope inverts positively, and the performance increase is more sensitive to the high and low mechanical OS, but the difference is too small to be significant ($\beta = 0.040$, $t = 0.594$, $p = 0.553$). Thus, mechanical structure OS did not change the relationship between collaboration and performance. In diagram B, the interaction is positive. Performance change is more sensitive to high than the low mechanical OS, and the difference is significant ($\beta = 0.177$, $t = 2.601$, $p = 0.009$). Thus, mechanical OS enhances the relationship between coordination and performance. In diagram C, the interaction inverts negatively, and the slope is reversed, showing that the increase in performance is much more sensitive to low than the high mechanical OS. The effect was significant ($\beta = -0.169$, $t = 2.651$, $p = 0.008$). Thus, mechanical OS lowers the effect of communication on performance.

Figure 4:

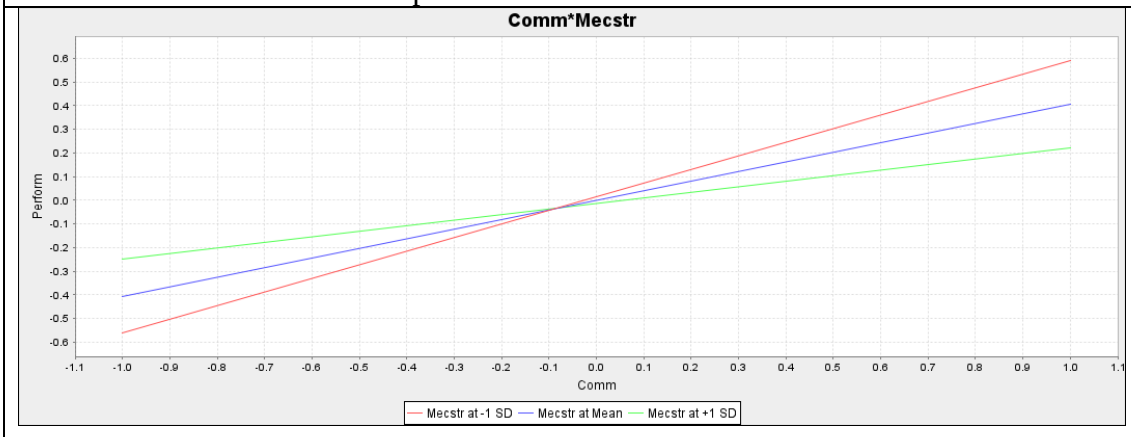
4A: Interaction Relationship between Collaboration and Performance



4B: Interaction Relationship between Coordination and Performance



4C: Interaction Relationship between Communication and Performance



Overall, the results of this study suggest three conclusions. First, cross-functional collaboration influences achieved integration performance, and the OS does not impact the effect. Second, cross-functional coordination positively influences achieved integration performance. When the strong mechanical OS is included, this relationship is enhanced. Third, cross-functional communication positively influenced achieved integration performance. Once the strong mechanical OS is included, this relationship is weakened.

VII. DISCUSSION

Results Discussion

The purpose of this research was to explore the effects of CFI on organizational performance. Drawing upon the theoretical framework of IPT (Tushman & Nadler, 1978), this study develops a model. The three primary constructs representing CFI, including collaboration, cooperation, and communication, and their effect on performance. (i.e., achieved integration) were examined.

We tested the model using online surveys that collected data from 325 participants employed in cross-functional units in their organizations. SEM was used to analyze data. The model is primarily supported. The insights from the model estimation and its findings are discussed below:

Collaboration

The first hypothesis (H_1), hypothesizing that collaboration has a positive effect on performance, was supported. High cross-functional collaboration leads to high achieved integration, thereby improving performance. The findings confirm that cross-functional

collaboration is a necessary component of OS and becomes vital for a firm to enhance performance. The results suggest that organizations may benefit from creating standards and promoting cross-functional lateral relations to facilitate cross-functional collaboration, guided by IPS. The results also indicate that for managers to solve problems, make decisions, and operate effectively, they would leverage collaborative knowledge across all its units in a seamless, integrative, and intuitive manner. The results further indicate that a collaborative team can work together productively to improve organization performance.

Moreover, the findings from this study support the literature that affirms that collaboration may enable adaptability via shared understanding of functions and vision. This can prepare cross-functional units to maintain high performance for circumstances as the changes are happening (Pellathy et al., 2019; Chen et al., 2017). The findings are also in line with the literature that collaborative teams working together via integration mechanisms can enable a stimulating discussion of new information and utilize it effectively (Egelen et al., 2012). Based on literature (e.g., Sanders & Premus 2005), to promote cross-functional collaboration and firm performance, managers should prepare their teams and organizations to adapt to change quickly via collaborative and knowledge sharing. To facilitate this, organizations can create a collaborative, friendly culture that includes teams and units in every aspect of decision-making regarding goal setting and outcome. If teams and units are knowledgeable about collaborative efforts, they tend to be comfortable sharing ideas and work together to achieve the company's performance goals.

Coordination

The second hypothesis (H_2), hypothesizing that coordination positively affects performance, was supported. High cross-functional coordination leads to high achieved integration, thereby improving performance. The finding is in line with what previous research have suggested about the relationship between coordination and performance. The finding also confirms that cross-functional coordination is essential in managing interdependencies across activities within the organization and functional units and that the focus should be on process performance (Flynn et al., 2010; Handfield et al., 2015).

The findings also suggest that cross-functional coordination entails ensuring that everyone is focused on process optimization instead of achieving individual functional goals. As the literature suggested (Stadler 2005; Chen et al., 2009; Handfield et al., 2015) and based on our findings, managers need to adopt a process perspective geared towards optimizing the overall activities and executing activities from individual functional areas to improve coordination and then performance.

Communication

The third hypothesis (H_3), hypothesizing that communication has a positive effect on performance, was supported. High cross-functional communication leads to high achieved integration, thereby improving performance. The findings suggest that communication that emphasizes the exchange or reciprocal flow of information is needed for organizations to support functional unit strategies and operations. The results are also in line with previous researchers' assessment of the relationship between communication and performance (Shoenherr & Swink, 2012). Communication is a critical element for

teams because members differ in their thoughts (Dougherty, 1992), resulting in mutual understanding of other areas' functions and objectives.

Giving the importance of cross-functional communication in performance, we believe that it is essential for managers to build internal capacity to facilitate such communication. One critical capacity is to create channels and mechanisms that facilitate acquiring, understanding, and transforming knowledge from other units (Akgun, Byrne, Keskin, Lynn & Imamogly, 2005).

Moderating Effect of OS

The fourth hypothesis (H_{4a-c}), hypothesizing that mechanical OS has a moderating effect that strengthens the relationship between CFI and performance, was partially supported. First, although we found a positive moderating effect, the effect was too small to be significant. Thus, mechanical OS did not change the relationship between collaboration and performance. This finding is not in line with most literature. One possible explanation is that sometimes mechanical OS can create an atmosphere that is not effective in facilitating collaboration. Specifically, when organizations create a strong mechanical OS with many rules and regulations that collaborative teams must follow, units' collaboration may be restricted by rules and regulations. Some literature confirms this to be true. Bai et al. (2017) demonstrated that when building a collaborative team in a mechanical organization, managers have to take into consideration of some formal roles and responsibilities and a strict unified command chain that deter collaboration. Another possible explanation is that when CFI collaborative teams have their own distinct roles and functional focus under a mechanical OS department, support and desire for collaboration tend to be lacking. The significant

finding also implies that the components to make collaboration successful, such as aligning group goals and working collaboratively to achieve those goals, are not affected by the OS. Therefore, managers should ensure that they put the necessary strategies in place to create an organizational structure that facilitates collaboration among their teams during their decision-making.

Second, mechanical OS enhances the relationship between coordination and performance. The finding confirms that coordination combined with a formal OS is essential in achieving integration and performance. The finding further suggests that coordination must be a seamless flow of operation that is fully synchronized, and mechanical OS needs to be designed in a way that facilitates this process through stick rules and policies. The finding is also in line with past research, affirming that to ensure the effectiveness of a mechanical OS, managers need to build OS systems that optimize the complete flow of processes and facilitate resolving any conflicts that may impact streamline processes and coordination (Stadtler, 2005; Chen et al., 2009; & Handfield et al., 2002).

Third, we found that mechanical OS weakens the relationship between communication and performance. While this is surprising, the finding reveals that mechanical OS could negatively affect the mobility and adaptability of organization members and thus create an adverse effect on communication and performance. Some literature might help explain such findings. Bai et al. (2017) confirmed that mechanical OS could cause information sharing among members to be distorted and slowed down due to solid hierarchy channels and strict chain of command. Their findings also suggest

that managers should make sure their communication lines are conducive to facilitating communication in mechanical OS.

While we have mixed findings concerning the moderation effect of mechanical OS, our findings revealed that mechanical OS does not always play a stimulus for the relationship between performance and CFI factors (i.e., collaboration, coordination, and communication). So, managers should consider this when they design this kind of OS. Organizations should look at their reporting systems in mechanical OS and make the necessary adjustments to their strategies to ensure the mechanical OS is not a constraint for CFI. Following the literature suggestion, organizations should include design features in the mechanical OS, such as reporting structures, incentives, metrics, and information systems that establish formal cross-functional linkages to support CFI (Ahmad & Schroe, 2003; Neely, Gregory, & Platts, 2005; Buckley, 2015).

This research examines CFI among several departments, units, and functions. CFI is not a new topic but still a challenging task for managers as they must quickly adapt to the changes in technology, organizations, and workforces. Among the three CFI, neither collaboration, communication, nor coordination showed more performance improvement than the other. This indicates that they are equally important, must be present, and work together to improve performance via a successful integration process.

Contributions

This study advances the theoretical understanding of CFI and provides insights for organizations dealing with complex operations involving multiple functional units. It makes several significant theoretical and practical contributions that are elaborated below.

Theoretical Contribution

From a theoretical perspective, this study provides several contributions. First, consistent with theoretical discussion, this research tapped into a developed construct that suggests modeling collaboration, coordination, and communication as first-order, separate factors to examine their impacts on performance. The research was extended to focus on the multiple areas of CFI and aid in further theoretical understanding of the topic.

Second, direct positive relationships were confirmed between the three distinct, independent variables of CFIs and a firm's ability to achieve a successful integration. This means that when collaboration, coordination, and communication are present and successful, the organization's performance improves. This contributes to the IPT that suggests that information-processing requirements must fit information-processing capacity available within an organization to increase its effectiveness and efficiency (Tushman, & Nadler, 1978; Flynn & Flynn, 1999; Bendoly et al., 2012; Graupner et al., 2015). The study also applies the organizational IPT subunits and processes.

Third, this study contributes to the literature by examining CFI through the lens of information processing and OS. It shows the importance of organizations developing the capacity to process information to leverage the synergy among groups and individuals as changes in structures, technology, and the environment happen.

Fourth, the study provides an understanding of OS's moderating role, specifically mechanical OS, on the relationship between cross-functional activities and the organization's ability to successfully achieve integration. This study only confirms OS's

moderating effect related to communication and coordination, indicating that OS's role concerning CFI is complex.

Managerial implication

This research provides contributions in several ways. First, the study informs organizations and managers a need to have smooth flowing operations to be effective. Executives and senior-level personnel need to encourage team collaboration, coordination, and communication among units to benefit the company. They can do this by giving members greater decision-making authority to make collaboration, coordination, and communication easier. The true value of an organization achieving a successful CFI lies in the fact that grouping efforts and resources to achieve the organization's overall goal are far greater than a single team's power. Also, to facilitate collaboration, coordination, and communication, managers may need to encourage teamwork, promote mutual goals, shared vision, and resources to increase the degree of CFI.

Second, looking at CFI as a core set of interrelated processes that focused on the collaboration of goals, coordination of activities, and communication of information (Pellathy et al. (2019) calls for discussion on cross-functional practices in organizations. The research model can be a practical conceptual framework for decision-making and tackling problems around integration. Managers can use the model as a guide in their implementation efforts and as a diagnostic tool to access internal integration.

Third, the complex effect of the mechanical OS found in this study suggests that managers who intend to facilitate and encourage cross-functional collaboration, coordination, and communication, but do not pay attention to the design of OS may not

achieve their intended objective of improving performance. Therefore, managers must be creative and assertive in juggling the needs for CFI, OS, and information processing. Our results suggest that CFI can be complex, and organization needs to adapt to changes quickly.

VIII. LIMITATIONS AND CONCLUSION

Limitation and Future Research

While this study makes significant contributions to the CFI literature and has important implications for business practice, there are some limitations that should be considered. First, the study uses a quantitative cross-sectional survey approach. This limits the research just to survey responses. Collecting information or data through other approaches, such as interviews, direct observations, or even documents, might give a broader picture of how respondents really feel about internal integration. A mixed-method approach could also be considered.

Second, CFI or internal integration is ever-changing, especially between customers, suppliers, and manufacturers. Conducting a one-time cross-sectional study may not be enough to capture all the areas of CFI. Future studies could take on a longitudinal approach to see how changes happen at a future date in time.

Third, the current study focuses on the OS and internal integration, meaning that this study examines CFI within the organization. However, external factors may come into play, such as customers, stakeholders, and partners. Additional studies could explore external integration relationships that might be important in the company's overall CFI and factors affecting such integration.

Fourth, this study focuses on just three factors related to CFI (collaboration, coordination, and communication) and their effect on an organization achieving integration. However, it did not consider conflicts that might occur when different functional units must work together. A significant move would be to look at other factors such as conflicts in an organization or functional departments during CFI. Future research can look at different conflict factors, resolution strategies, and the consequent effect on performance.

Finally, most organizations are very diverse and are multinational enterprises. They may operate in one country but has subsidiaries in other countries. They face conflicts between corporate culture and national culture. Future studies could look at how corporate cultures interact with national cultures and impact CFI. Existing research indicates that corporate culture and national culture characteristics are not independent. Some corporate cultures are more dominant in certain national cultures (Deshpande & Farley, 2004), implying a complex 3-way interface among corporate culture, national culture, and CFI. This is interesting future research.

Conclusion

CFI - performance relationship is very important to arrive at achieved integration. This research explores the effects of CFI on organizational performance. We looked at three main constructs representing CFI, including collaboration, coordination, communication, and their effect on performance (i.e., achieved integration). Also, the impact of OS was considered and predicted to have a moderating effect on the relationship between CFI constructs and performance.

The study draws on the theoretical framework of IPT (Tushman & Nadler, 1978) and applies it to investigate the direct effects of CFI on performance (achieved integration). According to the IPT, each organization is viewed as a body that collects, interprets, coordinates, and communicates information. The task, environment, and interdependencies during integration stages may create uncertainties for sub-units. To be effective, there must be a fit between information processing requirements and capacity, considering the integration mechanisms and the organization design. A model was subsequently developed to examine the conceptual relationships between CFI and performance. In this model, CFI constructs (collaboration, coordination, and communication) are conceptualized as the independent variables that influence performance. The results revealed that collaboration, coordination, and communication directly affect an organization's successfully achieving integration, and OS partially moderated the effect. The study contributes to CFI and information processing theory and provides insight on CFI for business.

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APPENDIX A: Empirical studies of cross-functional integration, organizational structure and performance

Empirical studies of cross-functional integration, organizational structure and performance					
Arthur(s)	**Context**	**Operationalization of internal integration**	**Theoretical foundation**	**Sample**	**Results**
Bai et al., (2017)	New Product Development team. MFG. & High-tech' production, MKTG	Organizational Structure, CFI and performance	Information Processing / Resource Dependency	268 university alumni; team & organ level	Mech OS to CFI (-); Organic OS to CFI (+); CFI to Performance (+); OS to CFI to Performance (+)
Bendolyet al., (2012)	MFG & MKTG; Supply Chain & MKTG	CFI coordination, information system capability, intelligence quality	New product development model (NPD); joint capabilities	1023 MFG managers; 386 different firms	role of CF_ coordination to IS capabilities (+)
Canacott et al., (2018)	MKTG, Sales	strategy implementation for CFI collaboration and communication strategies	No known theory. Grounded	2 stages of mgrs. 18 Executives from marketing & advertising agencies	Inter-functional communication is required to break down barriers. Strong demand for integration of content. Closer collaboration between sales & marketing functions is vital.
Chen et al., (2007)	MKTG, logistics, R&D	Firm-wide integration & performance; collaboration & integration/team collaboration	Constituency theory	Supply chain executive	mktg/logistics collaboration to firm performance (+); mktg/logistics collaborative activities to firm-wide CFI (+)
Deluca & Atuahene-Gime, (2007)	High-Tech R&D/MKTG	MKT knowledge dimension, CFI, & product innovation performance	Contingency theory & knowledge base view of the firm.	363 high-tech managers; 50 firms	market knowledge specificity and cross-functional collaboration affect product innovation performance through knowledge integration mechanisms

APPENDIX A: Cont'd

Empirical studies of cross-functional integration, organizational structure and performance cont'd					
Ellinger et al., (2000)	Logistics/MKTG/Manufacturing	MKT/Logistics integration and performance	Perceived effectiveness and information exchange approach	360 logistics & marketing managers	Positive association between collaboration and perceived effectiveness of inter-departmental relationships.
Engelen, Brettel & Wiest (2012)	New Product Development team & production	CFI and new product performance. National and corporate culture	The need for CFI is based in resource dependency theory. Functional dept. depends on resources and functions from other areas	619 firms, 6 countries, 321 participants	Strong cross-functional integration positively impact new product success
Ettlie & Reza, (1992)	MFG, R&D, Cust, Supplier	Integration and process innovation, coordination	No known theory. Grounded	39 plants, multiple industries	Integration significant with utilization. Cycle time, flexibility & service calls were not significant
Flynn et al., (2010)	Manufacturing	Supply chain integration and performance	Contingency and configuration approach	617 Supply chain mgrs. and executives surveyed	SCI is related to operational and business performance. Internal and customer integration were strongly related to improving performance than supplier integration.
Foerstl et al., (2013)	Purchasing, supply mgmt.	CFI and coordination		148 companies global cross section surveys	positive impact of cross-functional integration and functional coordination on purchasing performance, and of purchasing performance on firm performance

APPENDIX A: Cont'd

Empirical studies of cross-functional integration, organizational structure and performance cont'd					
Kahn, (1996)	MFG,MKTG, R&D	Collaboration and interaction	interdepartmental integration and product development performance	514 functional managers; electronics	Collaboration positively affects performance. More important than interaction
Le Meunier-Fitzhugh & Massey, (2019)	Sales and marketing	the effectiveness of cross-functional coordination mechanism			Not all coordination mechanisms are equally effective. Reducing conflict and increasing collaboration between sales & marketing positively influence business performance.
Lin, Wang & Kung, (2015)	Marketing, R&D	Knowledge creation and cross-functional collaboration	TC model that takes into account the effect of knowledge creation.	203 marketing, R&D high-tech managers	cross-function collaboration reveals fresh opportunities for creating knowledge. Knowledge creation plays an important role in TC performance through mediating the relationship between cross-functional collaboration and TC performance
Olivia & Watson, (2011)	Sales and Operations	CFI alignment in supply chain planning. Process attribute and constructive engagement	Grounded Theory, develop explanation for theory and practice	25 semi-structured, 45- to 90-min interviews with leaders and participants from all the functional areas involved in the S&OP process	process perspective was adopted and results show that integration was achieved despite formal functional incentives that did not support it.
Pagell (2004)	CFI with operations	Process of interaction, collaboration, cooperation		11 firms in USA	Job rotation, communication and reward system impact consensus and performance

APPENDIX A: Cont'd

Empirical studies of cross-functional integration, organizational structure and performance cont'd					
Pellathy et al., (2019)	CFI scale development/supply chain IT	Collaboration, coordination, communication	Reflective 2nd order constructs, a priori theoretical model	2 samples 182 & 182; SCM managers, USA	CFI relationships is based on trust, commitment and mutual respect
Schoenherr & Swink (2012)	Multiple functions working together	Cross-validation and extensions	Information processing theory-internal integration and capacity to absorb and use information		Internal CFI is directly associated with all dimensions of operational performance
Swink & Schoenherr (2015)	supply chain functions	CFI on profit, process efficiency and productivity	Information Processing Theory on achieved internal integration	115 supply chain management, 32 companies	Internal integration is positively associated with process efficiency, productivity, and asset productivity
Turkulainen & Ketokivi, (2012)	Manufacturing (electronics, machinery, & transportation)	CFI integration & performance: What are the real benefits?	Contingency Theory	266 mid-large size firms, 3 industries, 9 countries	CFI integration on performance is positive, but contingent and varies from one dimension to the next

APPENDIX B: Construct Items on Survey Instrument

Cross-functional Integration (adopted from Pellathy et al., 2019 and Makenzie et al., 2011)

Collaboration (α= 0.87, AVE = 0.63)

In my organization, different areas of the functional units work across functional boundaries to.....

1.	Jointly establish the overarching goals that direct our individual functional activities	0.769
2.	Make sure there is joint agreement on functional unit goals	dropped
3.	Engage constructively in debates about the goals of the functional units	dropped
4.	Ensure an open and transparent process for establishing common goals	0.815
5.	Establish a regular process for reviewing joint functional unit goals	0.820
6.	Support other functions in achieving common goals	0.768
7.	Adjust goals and objectives to reflect constraints faced by different functions	dropped

Coordination (α= 0.86, AVE = 0.60)

In my organizational, different areas of the functional units work across functional boundaries to.....

8.	Actively manage lead times across functions	0.772
9.	Ensure that functional activities are synchronized across the different areas	0.746
10.	Jointly manage interdependencies across functional areas	0.791
11.	Make sure everyone is focused on process optimization rather than achieving separate functional goals	dropped
12.	Make sure functional decisions do not conflict with each other	dropped
13.	Make sure functional areas see themselves as part of a larger overall process	0.796

Communication (α= 0.85, AVE = 0.60)

In my organizational, different areas of the functional units work across functional boundaries to.....

14.	Make sure relevant information gets to the right people in different functional areas.	0.767
15.	Keep key players in different functions informed about what is going on	dropped
16.	Make sure everyone understands what information needs to be communicated out to different functional areas.	0.806
17.	Make sure information that is being communicated is useful to those on the receiving end	dropped
18.	Make sure everyone understands how information is used in different functional areas.	0.770
19.	Make sure those on the receiving end understands why they are getting the information that they are getting.	0.718

Performance - Achieved Integration (adopted from Kahn & Mentzer, 1998; α= 0.84, AVE = 0.60)

Evaluate your organization based on the following:

20.	The functions in our organization are well integrated	0.803
21.	Problems between functions are solved easily, in the organization	dropped
22.	Functional coordination works well in our organization	0.756
23.	The functional units in our organization work well together	dropped
24.	Our organization functions coordinate their activities	0.743
25.	Our organization functions work interactively with each other	0.711

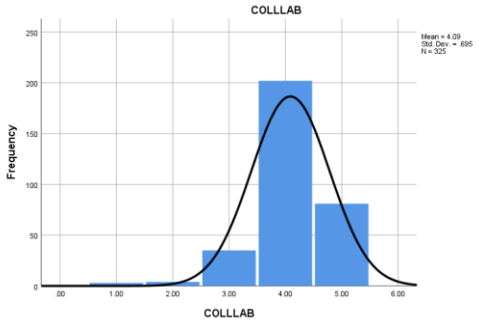
Organizational Structure (adopted from Miller & Drogel, 1996 and Bai et al., 2017; α= 0.93, AVE = 0.73)

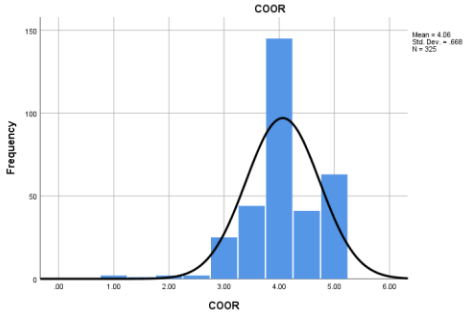
Evaluate your organization based on the following:

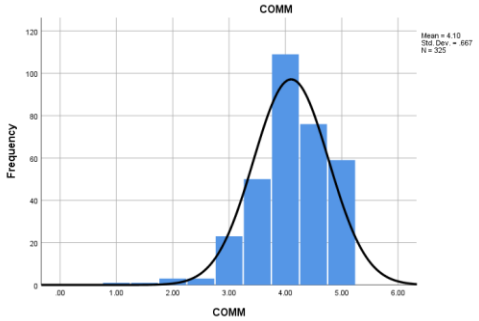
26.	The views of staff can be quickly transferred to business leaders	0.869
27.	Market information of product/services can be quickly feedback to the organization decision-making.	0.857
28.	Our organization is able to break departmental boundaries to collaborate and respond to Changes quickly	0.816
29.	Our organization can rapidly respond to market integration of resources required	0.885
30.	Our organization promotes team collaboration in order to enhance the ability to cope with change	0.847

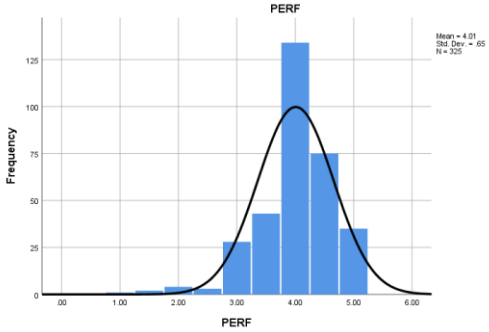
α= Cronbach's Alpha, AVE = average variance extracted

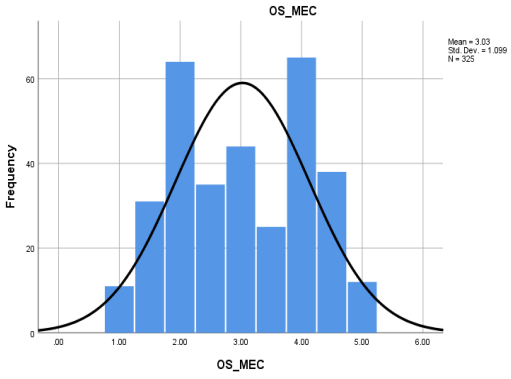
APPENDIX C: Normality Curves





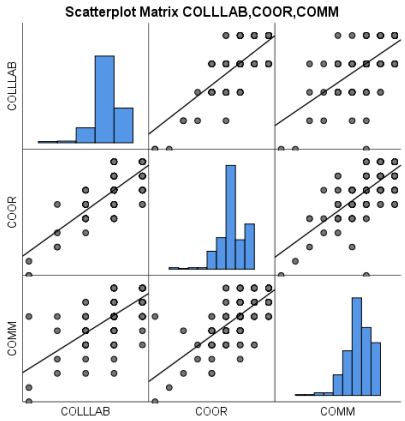




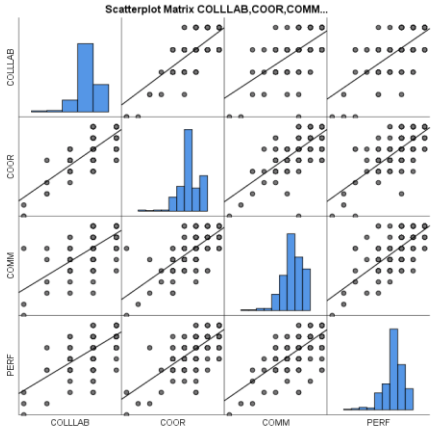


APPENDIX D: Scatterplot Matrix

D1: Scatterplot Matrix



D2: Scatterplot matrix CFI - performance



APPENDIX E1: MGA - Age

Multigroup Analysis - Age						
Relationship	Path Coefficients Original (OlderGroup)	Path Coefficients Original (YoungerGroup)	t-Value (OlderGroup)	t-Value (YoungerGroup)	p-Value (OlderGroup)	p-Value (YoungerGroup)
Collab -> Perform	0.111	0.284	1.016	3.465	0.309	0.001
Comm -> Perform	0.488	0.319	5.372	4.772	0.000	0.000
Coor -> Perform	0.289	0.345	2.757	4.196	0.006	0.000

APPENDIX E2:

Parametric Test - Age			
Relationship	Path Coefficients-diff (YoungerGroup - OlderGroup)	t-Value (|YoungerGroup vs OlderGroup|)	p-Value (YoungerGroup vs OlderGroup)
Collab -> Perform	0.172	1.267	0.206
Comm -> Perform	-0.169	1.499	0.135
Coor -> Perform	0.056	0.425	0.671

APPENDIX E3:

Welch-Satterwhait - Age			
Relationship	Path Coefficients-diff (YoungerGroup - OlderGroup)	t-Value (|YoungerGroup vs OlderGroup|)	p-Value (YoungerGroup vs OlderGroup)
Collab -> Perform	0.172	1.264	0.208
Comm -> Perform	-0.169	1.495	0.137
Coor -> Perform	0.056	0.425	0.672

APPENDIX E4:

PLS-MGA for Age			
Relationship	Path Coefficients-diff (YoungerGroup - OlderGroup)	p-Value original 1-tailed (YoungerGroup vs OlderGroup)	p-Value new (YoungerGroup vs OlderGroup)
Collab -> Perform	0.172	0.104	0.208
Comm -> Perform	-0.169	0.929	0.141
Coor -> Perform	0.056	0.335	0.670

APPENDIX F1: MGA-Gender

Multigroup Analysis - Gender						
Relationship	Path Coefficients Original (Female)	Path Coefficients Original (Male)	t-Value (Female)	t-Value (Male)	p-Value (Female)	p-Value (Male)
Collab -> Perform	0.122	0.231	0.910	2.985	0.363	0.003
Comm -> Perform	0.424	0.384	3.728	5.464	0.000	0.000
Coor -> Perform	0.357	0.312	2.865	4.026	0.004	0.000

APPENDIX F2:

Parametric Test - Gender			
Relationship	Path Coefficients-diff (Female - Male)	t-Value (|Female vs Male|)	p-Value (Female vs Male)
Collab -> Perform	0.045	0.323	0.747
Comm -> Perform	0.04	0.312	0.755
Coor -> Perform	-0.109	0.759	0.449

APPENDIX F3:

Welch-Satterwhait - Gender			
Relationship	Path Coefficients-diff (Female - Male)	t-Value (|Female vs Male|)	p-Value (Female vs Male)
Collab -> Perform	-0.109	0.709	0.480
Comm -> Perform	0.040	0.298	0.766
Coor -> Perform	0.045	0.309	0.758

APPENDIX F4:

PLS-MGA for Gender			
Relationship	Path Coefficients-diff (Female - Male)	p-Value original 1-tailed (Female vs Male)	p-Value new (Female vs Male)
Collab -> Perform	-0.109	0.763	0.473
Comm -> Perform	0.040	0.379	0.759
Coor -> Perform	0.045	0.372	0.744

VITA

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