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**Per aspera ad astra:  
An organization's pursuit of organizational  
ambidexterity, and its underlying mechanisms**

by

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requirements for the degree of

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## Abbreviations

DC	Dynamic capabilities
DMC	Dynamic managerial capabilities
DOD	Department of Defense
ESRC	Economic and Social Research Council
ISS	International Space Station
JSC	Johnson Space Center (NASA)
KSC	Kennedy Space Center (NASA)
LEO	Low Earth Orbit
MF	Micro-foundations (dynamic capabilities)
NASA	National Aeronautics and Space Agency (United States)
OA	Organizational ambidexterity
POC	Practice of circumventing
SAP	Strategy-as-Practice
STS	The Space Transportation System (the Space Shuttle program)
RISE	Revolutionize Space for Science and Exploration
UHCL	University of Houston Clearlake
USA (U.S)	United States of America

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## **Declaration**

This thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Philosophy (PhD). I declare that the work contained within this thesis is my own and has not been submitted for any degree at another university. I confirm that the work presented was carried out by the author.

# Thesis Summary

The title, *per aspera ad astra*, the ‘struggle to the stars’, speaks to this thesis in two ways. Firstly, the theoretical focus of this research project rests upon understanding the joint pursuit of exploitation (efficiency) and exploration (innovation), a concept otherwise known as organizational ambidexterity. To date, studies have demonstrated that organizations with the ability to achieve ambidexterity are apt to become leading star performers in their industries. Yet the pursuit of ambidexterity is difficult and fraught with tension; for exploration and exploitation are considered incompatible and demand fundamentally different skill requirements and capabilities. The research herein contributes knowledge to the field of strategy and change management by addressing an important but underdeveloped area of inquiry in examining *how*, in practice, an organization transitions towards an ambidextrous strategy and manages the exploration-exploitation duality (Birkinshaw, Crilly, Bouquet and Lee, 2016). Herein, the study focuses on the exploration-exploitation duality and addresses the research questions ‘how does an established organization transition in strategic pursuit of organizational ambidexterity, and what underlying mechanisms support or impeded its transition?’

Secondarily, to address this question an empirical qualitative case study analysis was conducted of an organization undergoing strategic change towards achieving ambidexterity, namely the NASA Johnson Space Center who strive to advance science and technology through the difficult endeavor of human space exploration. Utilizing a multimethod approach, rich qualitative data was gathered and through inductive reasoning and a grounded theory approach, theoretical insights were generated to develop theory. Broadly speaking, the study finds that: (1) an organization’s approach to ambidexterity is not static but evolves progressively with antecedents arranged in a layered pattern over time due to a dynamic relationship between exploration-exploitation. Consequentially, structural and contextual antecedents to ambidexterity are employed in a hybrid manner, and this is enabled by various distinct skills, processes and structures resembling the micro foundations of dynamic capabilities; (2) the formal and informal organization are important organizational features whose interaction creates a practice-based mechanism which, under certain conditions, engenders the informal organization to promote long-term change supporting the effective pursuit of ambidexterity; and (3) an organization’s history, when punctuated with crisis events, can have a paradoxical influence that simultaneously supports and impedes its approach to exploration and exploitation. The study contributes to a richer understanding of organizational ambidexterity and how an organization pursues and implements this strategy in practice. It also contributes to expanding our understanding of the processes, structures and micro-features engaged in the development of ambidexterity at different levels of the organization.

# Chapter One

## Introduction

*“The difficulty lies not so much in developing new ideas as in escaping from old ones”*

*– John Maynard Keynes*

Over the last decade, we have witnessed an explosion of literature and research from the fields of organizational management and strategy exploring the concept of organizational ambidexterity (Raisch and Birkinshaw, 2008). With the organizational environment becoming ever more dynamic and complex, together with the constraints of finite resources, managers in both the public and private sector must increasingly grapple with complex decisions and master the skill of managing competing internal tensions and demands. The ability to perform and balance different and often opposing activities at the same time lies at the heart of the ambidexterity hypothesis. Organizational ambidexterity scholars argue that an ambidextrous organization develops key competencies that engender superior firm performance (Simsek, Heavey, Veiga and Souder, 2009). Interest in organizational ambidexterity is warranted having been associated with several positive outcomes including optimal performance (Uotila, Maula, Keil and Zahra, 2009), sales growth (He and Wong, 2004), and knowledge sharing (Kauppila, 2010). A number of empirical studies have also given support to the ambidexterity hypothesis (Simsek et al, 2009; He and Wong, 2004; Lubatkin, Simsek, Ling and Veiga, 2006). He and Wong (2004) and Lubatkin et al’s (2006) statistical analysis found a positive relationship between firm growth performance and the joint pursuit of exploration and exploitation. And Uotila, Maula, Keil and Zahra’s (2009) longitudinal content analysis

of firm-level operationalization of exploration and exploitation activities found an inverted-U shaped relationship between long-term financial performance and the relative emphasis of ambidexterity. Thus, the ability to balance exploration and exploitation activities leads to optimal performance levels (Uotila et al, 2009). Similarly, case studies of exemplar companies such as Apple Inc. (Heracleous, 2013), USA Today (O'Reilly and Tushman, 2004), Toyota (Adler, Goldoftas and Levine, 1999) and Singapore International Airlines (Heracleous and Wirtz, 2014) provide real-world evidence of organizations who demonstrate ambidextrous capabilities and consequently outperform in their industries; thus, demonstrating the important value and contribution of ambidexterity research to academia and organizational practice. Yet, despite growing interest in ambidexterity research, scholars acknowledge that the ability to balance competing tensions effectively remains a difficult endeavor, which begs an interesting point for investigation for academics and practitioners alike. If organizational ambidexterity has the potential to engender highly-effective star performing organizations, then how in actuality does an organization go about transitioning to become ambidextrous and under what conditions? Additionally, which underpinning mechanisms support this transition or pose obstacles during this change process and why? Such questions persist and provide a launch pad from which to probe and go deeper, as to bridge the theoretic and pragmatic, in exploring the concept of organizational ambidexterity and how an organization pursues such an agenda.

## **Organizational Ambidexterity**

### **Defining organizational ambidexterity**

Ambidexterity research has grown rapidly since the turn of the millennium (Birkinshaw and Gupta, 2013) with contributions stemming from multiple streams of literature including, strategic management, organizational learning, organizational design and organizational adaptation (Raisch and Birkinshaw, 2008). Due to its various conceptualizations, there remains a lack of *consensus omnium* over the definition of organizational ambidexterity (Birkinshaw and Gupta, 2013; Gibson and Birkinshaw, 2004; O'Reilly and Tushman, 2013; Papachroni, Heracleous and Paroutis, 2014; Raisch and Birkinshaw, 2008; Simsek, 2009; Tushman and O'Reilly, 1996).

This thesis adopts a view of ambidexterity as an organization's capacity to simultaneously pursue and operate dualities or internal tensions in response to changes in its environment. This broad view draws from elements common across the varying interpretations posited by researchers (Simsek, 2009; Birkinshaw and Gupta, 2013) and does not adhere to a particular theoretical assumption as to the nature of organizational tensions (i.e. continuum, orthogonal or paradoxical) (see Gupta et al, 2006; Papachroni et al, 2014). In so doing, this allows the researcher to examine the nature and management of organizational tensions as they are perceived and operationalized through the perspective of actors involved in the organization's pursuit of ambidexterity.

### **The exploration-exploitation tension**

Scholars acknowledge that a multiplicity of tensions are present within organizations<sup>1</sup>. The most frequently examined and conspicuous tension within research has been the exploitation-exploration tension (March 1991), with theoretical and empirical studies analyzing how an organization may simultaneously achieve these two activities adjudged to be incompatible. However, as with the concept of ambidexterity, ambiguity surrounds the meaning of the terms exploration and exploitation (Lavie et al, 2010). This thesis assumes a general view of exploration as comprising the discovery of new knowledge and search for novel opportunities, flexibility, risk taking, experimentation, innovation, variation and embraces autonomy (March, 1991; O'Reilly and Tushman, 2008). Conversely, exploitation involves the refinement of existing competencies through variance reduction, maintaining stability in operations, efficiency (March, 1991), and "effective implementation, execution, certainty and control" (O'Reilly and Tushman, 2008: 189). Adopting this broad scope

---

<sup>1</sup> Scholars have identified and analyzed a multiplicity of organizational tensions which include adapting to environmental changes-alignment in present operations (Gibson and Birkinshaw, 2004), flexibility-stability (Bahrami, 1992), low cost strategic position-differentiation strategic position (Porter, 1980); change-stability (Leana and Barry, 2000), flexibility-efficiency (Adler et al, 1999), revolutionary-evolutionary change (Tushman and O'Reilly, 1996); retrenchment-investment (Paroutis, Bennett and Heracleous, 2014); centralization-decentralization (Lewis, 2000), short term performance-long term performance (Smith and Lewis, 2011); social orientation-profit orientation (Smith, Besharov, Wessels, and Chertok, 2012); local responsiveness-global integration (Bartlett and Ghoshal, 1989); intuitive-rational strategic decision making (Calabretta, Gemser and Wijnberg, 2017); similarity-distinctiveness employee identity (Cuganesan, 2017).

captures the various nuances, processes and practices that define the dimensions of exploration and exploitation.

### Facets of the antecedents to organizational ambidexterity

In observing the prevailing conceptualizations that address how exploration and exploitation may be pursued ambidextrously, one can conclude that they orientate around four main facets: (1) configuration of time, (2) mechanism of resolve the tension, (3) organizational feature, and (4) unit of implementation (see table 1).

Key dimensions	Means to ambidexterity	Authors
1. Configuration of time	Static (simultaneous)	Tushman & O'Reilly (1996); Birkinshaw & Gibson (2004)
	Dynamic (sequential)	Brown & Eisenhardt (1997); Boumgarden, Nickerson & Zenger (2012); Romanelli & Tushman (1994); Kang, Kang and Kim (2017)
2. Mechanism to manage tension	<i>Separation</i> of processes, systems, structures	Duncan (1976); Tushman & O'Reilly (1996)
	<i>Integration</i> of processes, systems, structures	Katila & Ahuja (2002); Farjoun (2010); Jansen, Tempelaar, Bosch & Volberda (2009)
3. Organizational features	Structural / architectural design	Duncan (1976); Tushman & O'Reilly (1997)
	Contextual /behavioural	Adler et al (1999); Gibson & Birkinshaw (2004)
4. Unit of implementation	Organization	
	<i>Inter-organizational</i>	Lavie & Rosenkopf (2006)
	<i>Intra-organizational</i>	Gibson & Birkinshaw (2004)
	Team	Lubatkin, Simsek, Ling & Veiga (2006); Liu & Leitner (2012); Heavey & Simsek (2017)
	Individual unit <i>Business unit</i>	O'Connor & DeMartino (2006)
	<i>Executive Leadership</i>	Smith, Lewis & Tushman (2016)
	<i>Employees on the ground</i>	Rogan and Mors (2014); Zimmerman, Raisch & Birkinshaw (2015)

Table 1: Summary of the key facets of organizational ambidexterity

The first facet, *configuration of time*, captures how organizational ambidexterity operates temporally, noting that organizational tensions may be balanced or managed either within or across time (Boumgarden, Nickerson and Zenger, 2012). In balancing the exploration-exploitation tension ambidexterity literature treats and configures time in two different compositions. First, time and ambidexterity are perceived to occur dynamically in that ambidexterity emerges through a sequential cyclical movement where the two elements of the tension (i.e. exploration and exploitation) alternate cyclically through time. The other perception assumes a static presence of time, where the balance of the tension happens in the same instance and both activities are managed in unison, simultaneously.

The second dimension, the *mechanism to manage tension*, pertains to the approach taken in order to manage and generate either balance or reconciliation between the two aspects of the tension. To date, ambidexterity literature outlines two mechanisms of balance, both of which are fundamentally different in how the nature of the exploration-exploitation tension is perceived. One mechanism to manage the tension contends that balance should be achieved through an approach that separates exploration from exploitation activities and both are managed independently, for the two are deemed to be irreconcilable (Tushman and O'Reilly, 1996). The second mechanism views explore-exploit activities to be congruent and therefore advocates an approach in which both activities are integrated (Hill and Birkinshaw, 2014).

The third facet, *organizational feature*, refers to the attributes inherent in organizations through which the balance or management of exploration-exploitation may be achieved. Ambidexterity literature to date has focused primarily on two organizational features, (a) the organization's business model and structural form (i.e. organizational design) (Jansen, Simsek and Cao, 2012; Markides and Oyon, 2010); and (b) its internal context and behavior (i.e. culture and values) (Gibson and Birkinshaw, 2004). However, little attention has been given to the role of other organizational features such as the informal organization and the role it plays in the process of becoming ambidextrous.

Lastly, the *unit of implementation*. For ambidexterity to be realized within an organization, research suggests that the unit level at which this competency is enacted may be critical to its effectiveness (Raisch, Birkinshaw, Probst and Tushman, 2009). Furthermore, existing studies have for the most part centered on three distinct levels of implementation – the organization, the group [team] and the individual unit. At the

organizational level, studies have suggested that ambidexterity may occur as an inter-organizational endeavor (i.e. collaborative partnerships and alliances) (Kauppila, 2010), whilst other researchers have examined how ambidexterity is achieved intra-organizationally, within the organization (Gibson and Birkinshaw, 2004). Although the writer of this thesis appreciates the inter-organizational argument for ambidexterity, the research focus of the thesis hereinafter concentrates on ambidexterity as an intra-organizational undertaking. In giving greater attention to the intra-organizational setting, the study contributes to understanding the internal construction and manifestation of organization ambidexterity, and what this transition looks like by considering its macro and micro dimensions, which is something that has been relatively underexplored (Stokes, Moore, Moss, Mathews, Smith and Liu, 2015).

Furthermore, the two other levels of implementation – group and individual – have within literature, tended to pertain to units internal to an organization. At the group level, scholars (Lubatkin et al, 2006; Smith and Tushman, 2005) have highlighted the role of executive management teams as being critical enabling levers of ambidexterity; with some studies indicating them to be its source in that they are the ones capable of balancing and managing the exploration and exploitation tension via managerial leadership capabilities and learning behaviors (Smith et al, 2010). In addition, senior management are considered to have the potential to drive and determine an organization's propensity to pursue exploration and/or exploitation by virtue of the biases and capabilities they may possess (Lavie et al, 2010). Other ambidexterity researchers have examined the phenomenon at the individual unit level, surmising its manifestation within a particular organization, work unit or amongst single individuals – namely executive leadership (Smith, Lewis and Tushman, 2016) and employees/individuals on the ground (Rogan and Mors, 2014).

Moreover, environmental factors and their influence on an organization's propensity to pursue exploration and exploitation has also received some research attention. Features such as an industry's competitive intensity and technological dynamism (Uotila, et al, 2009), environmental shocks/dynamism (Jansen, Van Den Bosch, and Volberda, 2005; Jansen, Vera, and Crossan, 2009a), and organizational history, as represented by a firm's size and age (Lavie et al, 2010), have received some empirical attention. However, as Lavie and colleagues (2010) note these studies have produced limited or mixed empirical results, thus highlighting a gap in our



understanding of the role and influence of factors such as history and environmental dynamism upon an organization and how it pursues ambidexterity.

## **Knowledge Gaps**

The four key dimensions, as represented in table 1, outline important facets central to understanding how organizational ambidexterity emerges and are features encompassed in prevailing theories on the antecedents to ambidexterity. Current research on the antecedents of ambidexterity is dominated by three main frameworks offering solutions to the exploration-exploitation conflict. These three frameworks are referred to as structural ambidexterity, contextual ambidexterity and dynamic/temporal ambidexterity. Studies on organizational ambidexterity and its antecedents thus far provide valuable conceptual and empirical insights on persistent internal competing tensions and the conditions that make it possible for organizations to achieve alignment or fit between their internal elements. However, gaps remain in our understanding of how the tension between exploration-exploitation is balanced or managed. Gupta, Smith and Shalley (2006) note that “although near consensus exists on the need for balance [of exploration and exploitation], there is considerably less clarity on how this balance can be achieved” (p. 697).

Existing studies on the antecedents of ambidexterity tend to focus their analysis on a particular approach or mode and, whilst this has helped in deconstructing ambidexterity as a concept, it offers a restricted perspective and understanding of how organizational tensions may be managed, performed or balanced. By conceptualizing the antecedents from a particular lens literature does not fully account for the complexity inherent within the process, and in the words of Turner, Swart and Maylor (2013) “the theorization of ambidexterity is inadequate for complex, practical realities and, in turn, this hinders the way in which it can aid the management of ambidexterity in practice” (p. 317). Ambidexterity writers contend that the prevailing antecedents should be viewed as complementary, and therefore balance is supposedly achieved through the engagement of multiple approaches rather than singularly (Birkinshaw and Gibson, 2013; Kauppila, 2010; Raisch and Birkinshaw, 2008). However, whilst this is conceptually acknowledged amongst researchers this line of discussion has received scant empirical attention within literature, nor has it been probed in ambidexterity article publications, which themselves have presented

mostly a single mode or approach to ambidexterity. If we are to deepen our understanding of how organizations become ambidextrous and the process by which it may be attained, then an examination of the complementarity and interrelations between antecedents could engender additional insights and open new avenues of investigation.

Academic exploration of organizational ambidexterity has also looked at several organizational mechanisms (instruments and devices) underpinning an organization's pathway to becoming ambidextrous. Gibson and Birkinshaw (2004) conceptualize two meta-constructs, performance management and social support, whose interaction they contend produces ambidexterity by creating a high performing organizational context. Other researchers have looked at network ties within and across organizations as being mechanisms that facilitate the connection between exploration and exploitation and underpin antecedent solutions to ambidexterity (Stadler, Rajwani and Karaba, 2014; Simsek, 2009; Mom, van den Bosch and Volberda, 2009; Rogan and Mors, 2014). For example, Beckman (2006) identifies managerial capabilities as an underlying determinant of ambidexterity. Interestingly, one of the main solutions to the ambidexterity dilemma, contextual ambidexterity, implies that the informal organization and its operations play a role in enabling ambidexterity, nonetheless this has not been extensively explored within literature. Rivkin and Siggelkow (2003) note "the many formal and informal structures, systems and processes that make up an organization's design affect one another" (p. 290). This suggests that if we are to fully understand how organizational ambidexterity is enacted research should strive beyond formal structures, processes, and systems to examine the informal organization and its interaction with the formal organization more explicitly.

Lastly, organizational scholars have acknowledged that time - its structure and subjective experience - is important in understanding organizational processes (Lord, Dinh and Hoffman, 2015). Dynamic/temporal ambidexterity depicts the significance of time in balancing the exploration-exploitation dilemma, however, deliberations of this solution have not elaborated on the role of organizational history or its potential influence on how ambidexterity may be achieved. History is crucial for it shapes an organization's present and emerging context (Pettigrew, 1979; Clark and Rowlinson, 2004). Lavie et al (2010) maintain that organizational attributes including age, size, capabilities, structure and resources are grounded within, and are also a product of, an

organization's history, thus suggesting that analysis of such features may be looked upon as proxies for organizational history. Studies have looked at whether an organization's age, size and prior experience influences its tendency to pursue exploration versus exploitation (Beckman, Haunschild and Phillips, 2004; Rothaermel and Deeds, 2004; Sorensen and Stuart, 2000), and have engaged concepts such as inertia, liabilities of newness, path dependency and access to resources as explanations for why an organization may have a predilection for either exploration or exploitation. In analyzing these organizational features such studies highlight the significance of an organization's history, however they shed little light on the effects organizational history has specifically in relation to an organization as it transitions in an effort to pursue exploration and exploitation ambidextrously. Current evidence would suggest that as organizations age they become increasingly inert structurally (Hannan and Freeman, 1984; Le Mens, Hannan and Pólos, 2011) and that history may be a core rigidity, particularly in the context of organizational change (Teece and Pisano, 1994; Barnett and Carroll, 1995). In relation to organizational ambidexterity, this would imply that established organizations may encounter additional obstacles when shifting to become ambidextrous.

However, existing conceptualizations of ambidexterity and its antecedents do not fully account for or expound on what historical precedents beyond age and size may influence an organization's transition to ambidexterity, or how organizational history may enable or impede an organization from attaining ambidexterity. Therefore, if we are to gain a better understanding of how ambidexterity may be attained, research may benefit from giving more explicit attention to the role and impact of organizational history, whether it constitutes an inhibiting or enabling force of ambidexterity and under what conditions. Furthermore, there have been growing calls from academia for greater consideration of history and an historical research approach to the study of organizational management and strategy (Suddaby and Foster, 2017; Godfrey, Hassard, O'Connor, Rowlinson and Ruef, 2016; Argyres, De Massis, Foss, Frattini, Jones and Silverman, 2017), and within the field of ambidexterity the role and impact of an organization's history in producing ambidextrous performance has received little explicit attention.

## Research Agenda

Despite mounting research interest lacunas remain in our current conceptualizations of organizational ambidexterity and the underlying mechanisms that engender the phenomenon. In referring to underlying mechanisms, this study draws upon the strategy-as-practice perspective (Golsorkhi, Rouleau, Seidl and Vaara, 2010; Rouleau, 2005) and Felin, Foss and Ployhart (2015) academic treatise on ‘microfoundations’ as a thinking approach which “call[s] attention to lower and inter-level mechanisms” (p. 578). The strategy-as-practice perspective focuses on the everyday activity of what people do and spurs an interest in the micro-activities, processes and practices of practitioners involved in the making and doing of strategy (Johnson, Melin and Whittington, 2003). In invoking micro and inter-level explanatory mechanisms (e.g. organizational activities, tasks, process characteristics and contextual features), this research study recognizes that heterogeneous lower-level organizational factors contribute to explaining organizational ambidexterity and its development, and hopes to gain insights into the features that underpin and contribute towards, or hinder the pursuit of ambidexterity. Felin et al (2015) note that “microfoundations are concerned with understanding how actors, their interactions, and the mechanisms and context that influence such interactions, produce firm-level and collective heterogeneity... [and] *crosses* several intervening levels between macro and micro” (p. 605-606). Hence, this approach entails multilevel considerations of a phenomenon and gaining an understanding of the interaction between the lower or individual level and the higher or macro level. Thus, this study assumes what Felin et al (2015) refer to as a multilevel approach in that it “does not privilege any particular analytical level” (p. 588), but engages with the organizational level, division/unit level and actor level.

Consequently, this thesis seeks to address two overarching research questions through empirical study:

- 1) How does an established organization transition to become ambidextrous in actuality?
- 2) What underlying mechanisms manifest during this process to support and/or impede the organization’s pursuit of ambidexterity?

The subsequent research investigation is motivated by two research objectives:

- (i) Develop a theoretical and empirical understanding of the pathways to organizational ambidexterity.
- (ii) Examine the change process an organization undertakes in a strategic effort to become ambidextrous and the key constructs that influence its pursuit.

The first objective concedes that the pursuit of ambidexterity is a process and may be sought by way of several approaches engaging with different mechanisms, some of which may have been overlooked in existing literature. The second objective gives emphasis to the pursuit of organizational ambidexterity as being a dynamic change process involving different constructs. I also note that these constructs do not function in isolation, for the way in which they connect and relate to one another may be pertinent to ambidexterity.

In addressing these two overarching research questions and objectives, the research program presented in this thesis pays attention to three areas which have received limited research attention, and in so doing hopes to make some headway in addressing these gaps. Firstly, this research project examines the issue of complementarity between the approaches (antecedents) to ambidexterity and how it is they may be engaged with interactively and the organizational instruments implicated. Secondly, the study consciously addresses the informal organization and its interaction with the formal organization as an influencing factor during the development of ambidexterity and focuses on practices embedded within the informal organization, and probes how and why the informal organization constitutes an enabling or inhibiting feature of ambidexterity. Lastly, the research focuses on organizational history and its impact on the transition to organizational ambidexterity, looking at how certain historical episodes may condition the organization's contemporary approach to ambidexterity and how it is perceived by organizational actors.

In attempting to address these research objectives this thesis engages with various organizational constructs, nonetheless, the overarching research program is bound together by two core tenets – (1) organizational change and the process of becoming, and (2) its philosophical commitment to an interpretative paradigm.

## **Change – the process of *becoming***

It is important to emphasize that the focus of this thesis is the process by which an organization *becomes* ambidextrous, rather than ambidexterity as an outcome or its sustainability. The concept of *becoming*, in relation to organization literature, deals with the issue of “changing” (Weick and Quinn, 1999: 382) at the most basic level, for it captures the process or event whereby an entity transitions from one state in an attempt to assume another (Ford and Ford, 1994). Change is one of the core tenets of management literature and the social sciences (Pettigrew, Woodman and Cameron, 2001). Explorations of organizational change include ontological debates as to the nature of change and its treatment in organizational research (Tsoukas and Chia, 2002), studies on the pace and typology of change (By, 2005; Van de Ven and Poole, 1995) – be it synoptic models of change as a planned episodic endeavor (Lewin, 1951; Romanelli and Tushman, 1994), or a continuous evolving process (Brown and Eisenhardt, 1997; Weick and Quinn, 1999), and level of implementation at which change occurs in relation to structures, strategy, systems, resources, processes and micro-processes (Hall and Ford, 2006). Weick and Quinn’s (1999) analysis of organizational change outlines various theoretical depictions, and their elaborate juxtaposition of episodic and continuous change provides a valuable framework in which to orientate this research program. In seeking to explore how an organization may transition to become ambidextrous, this research thesis can be seen to reside within Weick and Quinn’s (1999) notion of episodic change. Episodic change, the authors contend, connotes an intentional, radical and infrequent change which “tends to occur in distinct periods during which shifts are precipitated by external events such as technology change or internal events” (Weick and Quinn, 1999: 365).

Hence, in relation to ambidexterity, conventional wisdom in management strategy advocates that organizations pursue a focused strategy (Christensen, 1997; Porter, 1980, 1996) aligning behind either exploration or exploitation. For an established organization for whom ambidexterity constitutes a change in its strategic direction (i.e. it has traditionally pursued and operated within the confines of a focused strategy), the transition to ambidexterity would constitute an episode of planned strategic formal change, a decision assumedly initiated by senior management. It marks a radical divergence from the organization’s status quo for it requires they adjust to accommodate an unfamiliar competency and become adept in balancing these supposedly contentious activities. Radical strategic change is defined as being a

conscious process initiated by senior management intended to produce fundamental change in the very nature of the organization's core structures and activities (Mantere, Schildt and Sillince, 2012). Thus, the shift from a mono-dexterous position towards an ambidextrous one can represent a radical strategic change context for it may require that the organization's structure and/or core activities are reconstructed to enable both elements of a tension to be engaged with simultaneously, thereby disrupting its status quo. This episode of change can be seen to represent a distinct period of time, although, one could argue that the preservation of ambidexterity is itself a continuous process during which incremental modifications may occur within an organization's structure and/or behavioral operations. Nevertheless, further exploration of the sustainability line of argument for ambidexterity is beyond the scope of this current research project.

Although the proceeding research centers on a planned episodic change process, the study acknowledges the contention of Tsoukas and Chia (2002). Drawing on the work of Greenwood and Hinings (1996), Tsoukas and Chia (2002) contend that "to properly understand organizational change one must allow for emergence and surprise, meaning that one must take into account the possibility of organizational change having ramifications and implications beyond those initially imaged or planned" (p. 568). Consequently, in studying how ambidexterity may be pursued and attained the following research is not completely restricted by the boundaries of a planned change event but maintains a degree of openness in order to discover and gain an understanding of unexpected emerging mechanisms and instruments active in supporting or inhibiting this process towards ambidexterity. Furthermore, organizational change constitutes a shift not only in the formal structures and hard elements of an organization but also in the embodied actions and cognitive perceptions of organization's actors. In reference to organizational change, Jones and Van de Ven (2016) note that "it [change] also has important and often underestimated behavioral and psychological implications for individual employees" for "organizations only change and act through their members" (p. 32). Therefore, in order to understand an organization's transition to ambidexterity it is important to take account of how it is enacted and perceived by the organizational actors engaged in the process itself, in addition to movements in the organization's formal and structural features.

## **Philosophical Commitment**

### *Interpretive paradigm*

The research program herein is guided by an interpretive ontological and epistemological paradigm. Ontologically, the interpretive paradigm maintains that the social world is a constructed reality formed through the intersubjective experiences of the individuals who inhabit it and as such it is not a hard-objective entity capable of being reduced and evaluated through positivist means and logic (Berger and Luckmann, 1966; Burrell and Morgan, 1979). For the researcher seeking to understand a real-world phenomenon, the interpretive paradigm provides a conducive lens for it is informed and motivated “by a concern to understand the world as it is, to understand the fundamental nature of the social world at the level of subjective experience” (Burrell and Morgan, 1979: 28). Epistemologically, therefore, knowledge of this constructed reality may be obtained through the exploration and inductive interpretation of the lived experience of individuals as seen from their perspective, and the way in which they interpret, modify and create their experience (Burrell and Morgan, 1979). Put another way, “social realities are constructed by the actors in the context, acting together, and these acts can only be understood through interpretation” (Hatch and Yanow, 2005: 69). Heracleous (2001) emphasizes the importance of the researcher assuming the actors frame of reference explaining that “the conviction that accounts of social life must consider the actors’ frame of reference and be adequate at this level of first-order meaning” (p. 429). Intrinsically, this paradigm holds that there is no single objective reality to any research phenomenon, but rather multiple relative realities of those involved in the phenomenon (Hudson and Ozanne, 1988). The existence of multiple realities “emphasizes the relativistic nature of the social world” (Burrell and Morgan, 1973: 3) and confers the presence of different meanings which are difficult to interpret in terms of fixed realities (Neuman, 2000).

Organizations constitute a social world imbued with different meanings and interpretations and in order to understand them, it requires understanding how the organizational actors within them “develop, express and communicate meaning” (Hatch and Yanow, 2005: 66). Although an organization and its constituent parts may be united through shared values, norms and meanings, the lived experiences of individual employees are diverse and pluralist in form. So whilst there are points of similarities there will also be differences in the experiences and interactions employees



have with a phenomenon common across the organization. In application to this research study and its intention to understand how an organization may transition and pursue ambidexterity, one must look into and understand the phenomenon from the perspective of organizational actors, see it through their eyes and understand how they interpret the context, the strategy, the meanings they envisage and the rationale for their actions.

## **Methodological Overview**

### **Qualitative approach**

Guided by an interpretive paradigm the contained research study employs a qualitative methodology as it intends to empirically explore how an organization transitions from a mono-dexterous strategic position to an ambidextrous one. In so doing, the research seeks to generate new insights and build theory based on qualitative data through the inductive detection of patterns emerging from the empirical data (Eisenhardt and Graebner, 2007).

A qualitative approach is appropriate for exploratory studies for it locates the researcher within the world of the subject, corresponding with the philosophical paradigm guiding this research study, and enables an examination of the phenomenon within its natural setting (Creswell, 2013; Denzin and Lincoln, 2005). Thus, in the case of organizational ambidexterity a qualitative methodology allows the researcher to observe the transition process within a real-world setting, and gain an understanding from the perspective of actors engaged in the phenomenon. Creswell (2013) comments that qualitative research can be emergent in design which gives rise to the need for flexibility within the study, should changes occur during the research process. Eisenhardt and Graebner (2007) also note that qualitative research is an effective way to capture rich empirical data to study infrequent phenomenon, such as is the case of this research program which focuses on a strategic episodic transition towards organizational ambidexterity.

Graebner, Martin and Roundy's (2012: 278) alternative framework on working with qualitative data outlines three fundamental, advantageous characteristics of qualitative research approach. Firstly, the authors note the '*open-ended*' nature of qualitative data allows for flexibility in exploring a phenomena without having to

anticipate and establish definite constructs and mechanisms worthy of appraisal prior to data collection; and contend that this feature of open-endedness benefits theory generation. This characteristic has an affinity with this study for in addressing the primary research question of how an organization transitions to become ambidextrous the study is not constrained to focusing on a particular predetermined antecedent or mode of operating but is open which provides for a more holistic approach to capturing and theorizing the reality of an organization becoming ambidextrous. Secondly, Graebner et al (2012: 278) refer to the '*concrete and vivid*' nature of qualitative data, for utilizing this form of data allows for depth in theory development and the generation of abstract models rooted in real-life phenomena. This complements the intentions of this study to develop theoretical abstractions of organizational ambidexterity and the process by which an organization seeks to achieve this. Thirdly, the '*rich and nuanced*' nature of qualitative data captures the lived and subjective experiences of those it seeks to study (e.g. individuals) (Graebner et al, 2012: 278). Hence, in the case of this research study, a qualitative approach allows for the detection of details and mechanisms possibly overlooked by extant literature or quantitative studies (e.g. He and Wong, 2009; Uotila, Maula, Keil and Zahra, 2009).

Furthermore, the qualitative approach also serves to meet a methodological gap in current ambidexterity literature where scholars (Raisch et al, 2009; O'Reilly and Tushman, 2013) have called for more in-depth qualitative studies examining ambidexterity.

### **Embedded, single case study design and multimethod approach**

Case study research strategy "emphasize the rich, real-world context in which the phenomena occur" (Eisenhardt and Graebner, 2007: 25) and enables the researcher to study the dynamics of the event within its natural setting (Eisenhardt, 1989). Yin (2014) proposes three conditions in which a case study methodology is deemed preferable: (1) exploratory questions are presented asking 'why' or 'how' of underexplored phenomena; (2) the phenomena is beyond the researcher's control or manipulation, and (3) the study centers on a current phenomenon occurring in reality. The planned research can be seen to comply with all three conditions thereby indicating a methodological fit with this project.

To study the pursuit of organizational ambidexterity in action this research employs an embedded, single case study design (Yin, 2009)<sup>2</sup>. This single case design follows in the footsteps of other in-depth case studies in the field of strategy and management which examined a single organization (i.e. Burgelman, 1983; Corley and Gioia, 2004; Danneels, 2010; Harreld, O'Reilly and Tushman, 2007; Siggelkow, 2001), and industrial sociologists (e.g. Lockwood, 1966). This approach was selected for its suitability as it allows for the in-depth study of real-world complex phenomena in an everyday context and importantly, it gives consideration to the contextual conditions that influence the character and form of the phenomenon; thus prevents the divorce of context from phenomenon (Pettigrew, 1987). Eisenhardt and Graebner (2007) note that for phenomenon-driven research questions, such as the ones posed in this project, inductive case research, including a single-case study, is appropriate for it provides rich empirical data upon which to develop and build theory. Furthermore, Siggelkow (2007) contends that “a single case can be a very powerful example” (p. 20), and recognizes that case data can provide salient insights directly garnered from the world and contribute to the development of persuasive conceptual arguments on causal forces related to a phenomenon.

Although the study herein focuses on one organization's pursuit for ambidexterity, its embedded design means that it engages multiple levels of analysis (Yin, 2009) – the organizational level, the division/unit level, and the individual level – and is reflective of Simsek's (2009) idea of cross fertilization for it takes a cross-sectional view of the organization across all levels of the hierarchy. This embedded unit design is conducive to exploring the complexities in an organization's pathway to ambidexterity in action and its inner context - processes, structures, culture and social interactions – in greater detail. A few existing studies in ambidexterity literature assume a multi-level unit of analysis (Mom et al, 2009) and this project follows suit by adding to this body of research.

To operationalize the study a multimethod approach was employed as part of the ethnographic approach in which different types of qualitative data was collected (Creswell and Plano Clark, 2011). The study relied upon multiple sources and methods of data collection for triangulation and validity (Yin, 2014). This involved interviews with actors from different levels of the organization; direct observations of internal

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<sup>2</sup> Example of an embedded single case design is Lipset, Trow and Coleman (1956) study on the internal politics of the International Typographical Union as cited in Yin (2009).

communication events, interest group meetings, team meetings and cultural workshops; photographs of the organization's physical environment; documentary analysis of the organization's internal documents and presentations; published resources and historical archives. (See table 2 for a summary of the types of data collected for this research project).

Pettigrew (1990) explains that the study of organizational change requires a detailed longitudinal approach. Therefore, to investigate an organization's transition in pursuit of ambidexterity this project employed a longitudinal case design (Eisenhardt, 1989) and ethnographic research methods as part of fieldwork data gathering. Ethnography requires the researcher spend extensive periods of time embedded within the research context immersing oneself into the organization's culture, observing its actors and its operations to gain an enriched level of understanding and sensitivity to tacit elements of the data (Suddaby, 2006; Langley, 1999; Geertz, 1973), and detect new and unexpected constructs and organizational mechanisms which befits the intention of this research project.

### ***Ethnographic Phases***

Onsite empirical field data was collected in four phases between August 2014 and September 2015 (see table 3). Each onsite field trip occurred over a four to six week period taking place roughly in quarterly intervals. As the researcher, I spent three weeks in the field for phase one during which time in-depth interviews, non-participant observations, photographs and internal documents were gathered. For phases two, three and four the researcher spent almost four weeks in the field on each occasion and continued to conduct interviews, observations, and take photographs, as well as archival data gathering. Interview questions became progressively tailored to informants as each phase of the study developed, conditional on the informants' job role and tenure in the case study organization. (Appendix A includes a sample of the research questions asked during the study).

Sources of data	Number of items
Interview transcripts	82
Field notes (pages)	419
Photographs	74
Published books	7
Organization reports (budget, activity reviews)	12
Online communications and articles	17
Industry reports	6
Press releases and news articles	22
Documentary videos/audios (mass media)	7
<i>Archival items</i>	
Former employee interview transcripts	37
Strategy reports	8
Third party contracts and communications	23
Internal communication memos/news	19
Management system, rules and procedures	13
Organization charts	7
Independent management reports	4
Articles and thought pieces	11
Newspaper articles	9
<i>Internal documents (confidential)</i>	
Internal briefings	24
Internal communications/memos	17
Meeting minutes	2
Organization, division and program charts	10
Policy, and process & procedure documents	11
Strategy frameworks and action plans	20

Table 2: Outline of research data sources

This multiphase approach to data collection allowed me as the researcher to track and identify changes in organizational features during the organization's transition process. Each phase acted like a benchmark for the succeeding phase(s), against which I could detect and trace the organizational changes and developments occurring over time. Furthermore, the intervals between fieldwork data collection phases provided me with analytical distance to be reflexive (Hammersley and Atkinson, 2007; Schwandt, 2004). Throughout each phase I built my informal network using the organizational infrastructure (such as participating in employee resource groups and attending community events), and through informal social interactions (i.e. lunch invitations and participating in offsite social activities outside office hours and

weekends with members of the organization). This provided further opportunities for informal data gathering.

Phase one occurred during August 2014 and September 2014. Phase one marked my first encounter with the organization under study and introduced me to the setting, a subset of employees and aspects of its culture as experienced by organizational members. The case organization was two years into its strategic change program at that point and the implementation process was underway. Being my first field visit, phase one involved early discussions of actor perceptions and understandings of the organization's new ambidextrous strategic vision, what activities, processes, systems or organizational features had been introduced as part of implementing the ambidextrous strategy. Data collection involved facilitating two workshops over a two day period on the topic of the organization's looking at its 'past, present and future'. Workshops were open to all employees across the organization and attendance was voluntary. In total 70 individuals, a mix of contractors and permanent employees from different divisions and levels of seniority, participated in the two workshops. The workshops consisted of group discussions on its culture, structured by the cultural web framework (Heracleous and Langham, 1996; Johnson, 1988) and provided useful insights into actors' views. The majority of workshop discussions focused on the organization's current culture. Participants with longer employment tenures provided reflections on what aspects of the organization's culture they thought had changed and what aspects they perceived were inhibiting change. Whilst these reflections may be open to nostalgia and other biases they aid in understanding how actor experience of organizational culture has changed, and informs longitudinal analysis. Participants discussed what they believed needed to change for the organization to be successful in the future. Extensive field notes were taken during the workshops of participant discussions, interactions and social behaviors. Semi-structured interviews were then conducted with nine individuals who had attended the workshops and who voiced an interest in participating in the study. Interviews focused on participants' past and present experiences at the organization, and perceptions of its strategic and cultural evolution, the organization's current operational and cultural climate and their perceptions of the new strategy towards organizational ambidexterity and its implementation. During this phase I received limited access to the organization's intranet which provided me the opportunity to

become familiar with the organization's internal systems and processes and I began to examine internal documents relating to the new strategic ambidextrous vision. It was during this phase I first began to observe and identify the role of informal practices, how actors engaged these practices in relation to implementing the new ambidextrous strategy and its interaction with formal organizational elements.

Phase two took place between November and December 2014 with an added focus on how the strategy was being implemented and recent developments that had occurred. This phase built upon discussions held during phase one but occurred during an organizational restructure aimed to streamline reporting channels to executive management, combine capabilities by merging together two divisions (i.e. directorates) and further encourage collaborative innovation. Interview questions orientated around the restructure, the changes experienced and witnessed as a result, the effect of the change on operations and the way things are done, what actors comprehended as the intention of the restructure and new strategy; what they expected and or understood to be the outcome of the restructure; and what was the nature of innovation and collaboration. Furthermore, I continued to examine and observe the significance of informal organizational practices, which I had first identified during phase one, by questioning informants on the standard social behaviors in the organization, whether they differed from the past, the means by which individual actors and/or a division unit implemented the ambidextrous strategy and the challenges or obstacles they experienced. These questions helped provide insights into micro-level practitioner activities, their perceptions of the ambidextrous strategy and assessment of success. I continued with field observations across the organization and conducted 34 interviews. The majority of informants were previously unknown (i.e. they did not participate in the workshops in phase one) and were approached using snowball sampling. Four of the interviewees were former employees who had left the organization within the last seven years. The employment distance allowed for very candid conversations. External space industry experts were also interviewed to help provide a deeper understanding of the industry environment from a practitioner's perspective. During phase two, the significance of organizational history and its influence on the strategic transition process towards ambidexterity became apparent through discussions and interactions with informants and inspection of internal documentation. Consequently, this spurred initial exploration of archival items and records specific to the case organization located at the local archival library.

Early examination of archival documents focused on previous organizational/division structures, strategic plans and organizational changes (i.e. processes and systems) which helped provide an understanding of how the organization had developed and evolved structurally over time.

Phase three occurred from March to April 2015 and extended data gathering in terms of scope and activity. During this phase a further 11 interviews were conducted with informants both known and unknown to the researcher. Interviews and interactions with actors enabled me as the researcher to track developments and changes post the organizational restructure, which was underway during phase two of data collection, and had been captured during previous data collection phases. Discussions also addressed the nature of processes, procedures and the mechanics of day-to-day activities of individuals and teams in select divisions (such as knowledge management, finance and engineering). This focus provided a deeper understanding of practitioner day-to-day activities at the micro-level and how practitioners connect these activities with implementing exploration and exploitation. In addition, phase three involved gathering additional data pertaining to the organization's history (i.e. archives and published material referencing to the organization's history since its founding in the early 1960s). Particular focus was given to data relating to historical critical negative events and achievements as references to these repeatedly came up during interviews and in observations of organization wide events, and informal encounters with organizational actors.

Phase four took place from August to September 2015 and extended activities conducted in phase three. A further 26 interviews were conducted and questions were more focused and probed key topics and areas of research interest that had arisen from earlier research phases. During this phase, greater focus was also given to the organization's largest division (in terms of budget allocation and number of employees). Through informal social interactions outside office hours, the researcher learnt of a change initiative underway within this division intentionally designed to enable the simultaneous pursuit of exploration and exploitation activities. Interviews were conducted with individuals operating within the division and those who held key roles within the change initiative. Focusing on this particular division/unit provided me as the researcher with a narrowed detailed understanding of the modes and antecedents to ambidexterity at a discernable unit level, how this change process had evolved over time and the micro features and mechanisms hindering and/or enabling



this transition across different levels of the division (i.e. ground level individuals, middle managers, senior management and the unit as a whole). The data gathered during this phase is of particular significance to chapter two (paper one) in this thesis.

Data collection continued until theoretical saturation (Dey, 1999) was achieved. In between each of the four phases the data collected was analyzed and core findings were intermittently reported back to selected managers. This served as a way of confirming and validating the accuracy of my findings and the researcher's interpretation of comments and discussions held with informants. It also helped to inform the findings and emerging theoretical themes during the data analysis process and received feedback that the summary reports of findings provided valuable insights into employee perceptions and the organization's cultural climate and confirmed the findings were representative of the organization. In June 2017, following completion of data collection, analysis and early write up drafts, the researcher presented the full research findings to various members of the case study organization. Attendees to the presentation included those who had participated in the research and contributed to the interview data, members of the largest division/unit, and employees and contractors from different levels of the organization with an interest in hearing the results.

### **Inductive reasoning and grounded theory approach**

Whilst examining organizational ambidexterity and the experiences of organizational actors within a real-life setting, the study exercised inductive reasoning in order to build theory from the qualitative data (Denzin and Lincoln, 2005). In relying on qualitative data the study follows in the character of inductive case studies in which the outcome is to systematically generate explanatory models or theoretical propositions (Mantere and Ketokivi, 2013). Furthermore, building theory from case research also has the advantage of providing creative insights and generating novel theory (Eisenhardt, 1989). Adopting Eisenhardt's (1989) formulation of inductive case research, as the researcher, I sought to gain theoretical insights and derive generalizations developed in a manner driven and grounded in the raw data (Glaser and Strauss, 1967).

	August - September 2014	November-December 2014	March - April 2015	August - September 2015	Total
	Phase 1	Phase 2	Phase 3	Phase 4	
Workshops	2 cultural workshops 70 participants	--	--	--	
Interviews	11 interviews	34 interviews	11 interviews	26 interviews	82
Photographs of physical environment	37 photos	--	13 photos	24 photos	74
Field observations	14 days	16 days	16 days	18 days	64
Archival data	--	26 items	67 items	38 items	131
Internal documents (confidential)	4 items (hardcopy)	9 items (hardcopy & electronic)	58 items (electronic)	13 items (electronic)	84

Table 3: Summary of research data collection process

Glaser and Strauss (1967) argue that the development of valid theory can result from study that is grounded and intimately connected to empirical data. This grounded approach allows me, as the researcher, to engage with a phenomenon for which there are still gaps in our understanding and extant literature, and provides the opportunity to generate novel insights into the organizational ambidexterity phenomenon.

Although a number of data sources were gathered during the course of this research project, this study does not make direct or explicit reference to certain data sources, namely photographs taken onsite at the selected organization of its physical environment, and internal meeting minutes, however, these served to provide me with contextual understanding and contributed to the development of analytical themes. For example the photographs provided visual representations of tangible cultural features of the organization which helped establish context and aided me as the researcher to situate organizational actors.

### **Overview of selected case organization**

Using theoretical sampling (Glaser and Strauss, 1967; Eisenhardt, 1989) the National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) in Houston, Texas (USA) was selected as the research site for it provides a revelatory and illuminating case (Eisenhardt and Graebner, 2007; Siggelkow, 2007) in which to explore and gain insights on the real-world actions of an organization in pursuit of ambidexterity, and how its systems, structures and organizational actors transition from a focused strategy to an ambidextrous one. (See appendix B for details of JSC's strategy and its background).

In 2013, amidst an environmental context characterized by disruptive change and the emergence of new industry players, JSC Center Director introduced a new strategy that focused on the simultaneous pursuit of innovation and efficiency. This new strategic aspiration reflects JSC's drive to develop and manage exploration and exploitation capabilities simultaneously indicating an ambidextrous pursuit, making it an ideal case for investigation. In addition, during the course of the onsite field work for this research project (from August 2014 to September 2015), JSC underwent an organizational restructure designed to support the exploitation element of its ambidextrous strategy, JSC 2.0, by streamlining the number of direct reports to executive management. Witnessing this change event first-hand provided me, as the

researcher, a valuable opportunity to observe the adaptation process from the ground up and its impact on the organization's broader pursuit of ambidexterity as perceived and interpreted by organizational actors who were themselves living through the change.

Structurally, JSC is a large complex hierarchical organization characterized by a technocratic culture and bureaucratic administrative systems. The organization consists of several departmental units (directorates) each of which contain a number of offices. At a fundamental level these departmental units are categorized by organizational insiders as being either 'program-side' or 'institutional', where the former relates to the specific space programs funded directly by Congress, whereas the latter pertains to divisions/units responsible for the Center's operational infrastructure and maintenance and also provide support to the space program as and when required. The largest division at JSC (in terms of budget allocation and number of staff) is the International Space Station (ISS) space program. This multi-level structural makeup provides an interesting opportunity to gain a holistic cross-sectional view of the organization and ambidexterity at all different levels. Having been permitted access to organizational members from various departmental units and offices across JSC, the researcher has the opportunity to intentionally engage multiple levels of the organization in exploring the ambidexterity phenomenon, thus adding depth to the research and its analysis.

## **Thesis Structure**

This research program aims to address research lacunas within current organizational ambidexterity literature by examining key factors pertinent to the concept of ambidexterity and the way in which an organization transitions in an attempt to become ambidextrous. The thesis is comprised of three papers, and each paper constitutes a core chapter and offers constructive engagement with the concept of ambidexterity, and seeks to contribute to extending current thinking by generating some original theoretical insights.

The first paper, "*The evolving hybrid: an alternative perspective on organizational ambidexterity and its antecedents*", probes the notion of complementarity between the antecedents to ambidexterity, and the nature of the exploration and exploitation

tension and its accommodation. In empirically examining an organization's approach as it endeavors to operate exploratory and exploitative activities simultaneously, this paper explores how an organization may engage with different antecedents interrelatedly. Whilst ambidexterity scholars posit that ambidexterity is achieved through the combined employment of structural and contextual solutions (Kauppila, 2010; O'Reilly and Tushman, 2013), empirically studies have tended to examine the phenomena by looking at one approach, thus limiting our understanding of how ambidexterity is achieved in practice (Agostini et al, 2016). Through a longitudinal in-depth case analysis of the largest space program in operation at the Johnson Space Centre, the International Space Station (ISS), this paper looks at how the unit evolved to simultaneously pursue exploration (science) and exploitation (engineering). The findings highlight the fluctuating nature in the exploration-exploitation tension and the context/situations that give rise to this. The study contributes to our understanding of how the different approaches to ambidexterity can be employed intergatively over time through a hybrid approach, and highlights the layered manner in which the different modes are interrelated. The study also contributes to expanding our understanding of the context-reshaping capability that shapes this hybrid approach.

Paper two is titled "*The practice of circumventing: interaction of the formal and informal organization as a dynamic capability*". Organizational ambidexterity is allied with the concept of dynamic capabilities and both relate to an organization's ability to adapt and change in order to explore new and exploit existing capabilities. Dominant approaches to organizational ambidexterity refer to formal organizational features as the vehicle enabling the balance between exploration and exploitation. However, implicit in contextual ambidexterity, and to a lesser extent structural and dynamic ambidexterity, is the enabling role played by the informal organization and informal practices. There is growing recognition that the informal organization can play an important role in strategy implementation and organizational operations, but there is a gap in our understanding of the interplay between the formal and informal organization and how they combine and give rise to unexpected arrangements. Using ethnographic data, the paper identifies an emergent mechanism - 'the practice of circumventing' - akin to a positive deviant behavior, which arises out of the interaction between formal and informal organizational elements. This practice is found to be reflective of Tece's (2007) three core processes of dynamic capabilities

and, under certain conditions, has the capacity to promote both explorative and exploitative activities. The study contributes a nuanced understanding of how formal and informal organizational elements interact in practice at an actor level, and expands our understanding of how emergent practices can function as and contribute towards dynamic capabilities.

The third and final paper, “*Historical embeddedness, crises and its influence on the pursuit of organizational ambidexterity*” examines how organizational history and past crisis-trauma events influence an organization’s contemporary strategic change towards ambidexterity. Employing a longitudinal case analysis of JSC, this paper examines the organization’s founding imprints, history of crisis-trauma events and the consequential effect this had on the organization. The study identifies two historically embedded processes – sustained imprinting and the reprinting process – that actively influence the organization’s contemporary framing and approach to exploration and exploitation. Furthermore, the reprinting process when triggered by past crises is found to have a paradoxical influence on the organization’s approach to exploration and exploitation; for it engenders the organization to change and be open to exploration and exploitation activities, but simultaneously establishes rigidities by circumscribing the parameters defining exploration and exploitation, thus constraining the effective pursuit and manifestation of ambidexterity. The study contributes a multidimensional understanding of organizational history and its influence on an organization’s strategic present context, and provides insights into organizational imprinting and sensitive periods. It also shows how history contributes to developing paradoxical tensions existing within organizations.

The thesis’ denouement addresses the overarching research questions, outlines possible managerial implications and suggests avenues for future research.

# Chapter Two

## The evolving hybrid: an alternative perspective on organizational ambidexterity and its antecedents

### INTRODUCTION

In an increasingly complex demanding environment the ability to explore new capabilities whilst exploiting existing ones is considered essential for superior performance and sustained competitive success (Gibson and Birkinshaw, 2004; He and Wong, 2004). March's (1991) seminal treatise on exploration and exploitation in organizational learning highlights a tension between these two critical independent activities and argues that, though challenging, finding an appropriate balance between exploration and exploitation is a necessity for organizational survival. Thus, the question of *how* an organization manages to pursue both exploration and exploitation bares critical significance for academia and practice. Since March's seminal (1991) publication, research interest and consensus has grown arguing for an ambidextrous perspective, where two seemingly disparate activities (i.e. exploration and exploitation) may be pursued at the same time (Gupta et al, 2006; Simsek et al, 2009), which throws challenge to conventional wisdom.

The organizational ambidexterity concept has been theorized and defined in a variety of ways (Birkinshaw and Gupta, 2013; Simsek, 2009; Raisch and Birkinshaw, 2008), but central to its premise is the significant relationship between ambidexterity and organizational performance (Junni, Sarala, Taras and Tarba, 2013). Empirical studies of real world ambidextrous organizations have helped to advance the concept

beyond theorization, providing further depth of understanding as to its viability (i.e. Adler et al (1999) study of Toyota; Holmqvist (2004) case study of a leading Scandinavian software producer; Heracleous (2013) investigation of Apple Inc., and Heracleous and Wirtz (2013; 2014) study of Singapore Airlines). In conceptualizing ambidexterity, scholars have sought to establish how organizations can adapt to achieve balance noting it to be a difficult endeavor with organizations struggling to operate ambidextrously (Gibson and Birkinshaw, 2004; Voss and Voss, 2013). Examination of the pathways to achieving organizational ambidexterity has been a topic of discussion in organization theory and management literature. Engaging a number of theoretical perspectives, including network theory (Stadler et al, 2014), organizational learning (Levinthal and March, 1993) and paradox perspective (Andriopoulos and Lewis, 2009; Schmitt and Raisch, 2013), researchers have sought to understand and explain the development of ambidexterity and the intra- and inter-organizational factors that engender it. This has been broadened by investigations into enabling factors such as the role of networks (Gulati and Puranam, 2009; Stadler et al, 2014), organizational learning (Holmqvist, 2004), ambidextrous leadership (Smith and Tushman, 2005; Lubatkin et al, 2006; Smith, Lewis and Tushman, 2016) and the influence of moderators (Auh and Menguc, 2005; Atuahene-Gima, 2005; Lubatkin et al, 2006). To date theorization on the pathways to ambidexterity are dominated by three antecedents: (1) structural ambidexterity, (2) contextual ambidexterity, (3) temporal/dynamic ambidexterity. (Herein, this paper uses the terms ‘antecedents’ and ‘pathways’ interchangeably to refer to the different approaches assumed by an organization in order to achieve ambidexterity).

All three antecedents are presented as being distinct and differ in terms of organizational form – focusing either on structure and processes or behavioral systems – in addition to the level of implementation, and the way in which the antecedent habilitate the dual pursuit of exploration and exploitation. However, examinations of the ambidextrous pathways pursued by organizations in an effort to succeed in performing both dimensions of the exploration-exploitation tension have tended to look at the phenomenon through a single lens and focus on one mode of operating, thus implying that an organization adapting to become ambidextrous may engage with only one approach. Simsek (2009) notes that by looking at the ambidexterity phenomenon through one pathway as an explanation for its incarnation, current research in this field lacks an integrative understanding of organizational ambidexterity



and its manifestation across multiple levels. Interestingly, despite the differences between the modes to ambidexterity, scholars propose that these approaches are, in actuality, complementary (Gibson and Birkinshaw, 2004) but what this means or looks like remains unclear and has not been expanded upon in literature (Kauppila, 2010; O'Reilly and Tushman, 2013). For example, in Kauppila's (2010) study of inter-organizational partnerships and ambidexterity he hypothesizes that, in reality, ambidexterity is likely achieved through a combination of approaches and at various organizational levels rather than by means of just one antecedent, although he does not go further or provide deeper analysis or empirical support for his assertion. And more recently, Agostini, Nosella, and Filippini (2016:131) assert that "to date, an integration of all the approaches is still lacking, 'leaving an important gap in our knowledge of the theory and practice of ambidexterity' (Chang and Hughes, 2012)". This raises key questions as to how the antecedents may be harmoniously engaged from within the same organization, and why would such a condition occur? Furthermore, we have a limited understanding of the micro-mechanisms supporting ambidexterity in practice (Asif, 2017). O'Reilly and Tushman (2011) contend that "what is needed is greater insight into the specific micro-mechanisms required for a manager to implement and operate an ambidextrous strategy" (p. 8), thus echoing the need for research to examine what organizational [micro-]mechanisms or features underpin and enable this to happen, and at what levels within the organization do these manifest?

This paper seeks to address the aforementioned questions by conducting an empirically grounded, longitudinal in-depth case-study of a vital large organizational unit located at the NASA Johnson Space Center (JSC) in Houston, Texas (USA). The following focuses on the NASA's International Space Station (ISS) program which has evolved over time and recently underwent radical change in an effort to adapt and develop capabilities in balancing exploration and exploitation activities. The findings contribute to ambidexterity literature by demonstrating that the pathway to ambidexterity evolves progressively over time, with the different structural and contextual antecedents being integrated in a layered pattern, conceiving a hybrid layering mode. In being layered, the modes were interrelated by their shared commonalities (i.e. structural differentiation or degree of integration) However, in combining the different antecedents, the form and character they assume alters appearing to recast what has traditionally been depicted, leading to an alternative

perspective and understanding of how ambidexterity may be achieved. To this end, the study found that this hybrid mode to ambidexterity was borne out of the fluctuating disposition of the exploration-exploitation tension that surfaced in two regards. Firstly, in relation to the state of tension, findings indicated that the tension did not maintain a steady state but would shift in emphasis over time towards one element depending on environmental factors and changes to its internal context. And secondly, the relationship between the two dimensions (exploration-exploitation) and their management, as perceived by actors, changed from a condition of maintaining distinction and a degree of balance between the two conflicting dimensions to a state of reconciling them. From the analysis, it emerged that middle managers play a critical role in initiating, designing and driving the shape of this hybrid mode to ambidexterity, and what's more, the micro-processes of dynamic capabilities – sensing, seizing and reconfiguring (Teece, 2007) – were found to reside in and be enacted by middle managers. It emerged that what enabled these dynamic capability traits to manifest at the middle management level was (1) bidirectional cognitive dissonance between senior management and ground level staff, and (2) the deliberate engagement of unconventional informal practices endorsed by the senior director.

This study contributes to ambidexterity literature by giving insights into the fluctuating and paradoxical nature of the exploration-exploitation tension and begins to expand our understanding of the varying evolving forms and modes that operating ambidextrously can assume, and how they may be conditioned by the organization's circumstances. It also gives insights into the managerial capability to achieve ambidexterity, highlighting the significance of middle managers not only in its initiation, as conferred by Zimmermann, Raisch and Birkinshaw (2015), but also in its direct design and implementation. Secondly, the research case contributes to our understanding of where dynamic capabilities can be held in an organization by extending our understanding of how 'reconfiguring', by virtue of context shaping capabilities (Birkinshaw et al, 2016), can occur at organizational levels beyond senior management.

The rest of this paper is organized as follows. First, I discuss the core theoretical concepts of organizational ambidexterity and its antecedents as held in literature. Thereafter, I describe the empirical context and detail the key findings of the case and develop theoretical insights of how the hybrid mode to ambidexterity evolved within a large organizational unit and its antecedents. I conclude with a

discussion of the key findings, its theoretical contributions and implications for future research and management practice.

## **THEORETICAL BACKGROUND**

### **Theoretical perspectives on the nature of the exploration-exploitation tension**

#### *Exploration-exploitation as separate and conflicting*

An organization's approach to managing exploration and exploitation, in an effort to attain ambidexterity, is dependent upon the perspective it assumes as to the nature of the relationship between the two activities. First postulated by March (1991), exploration-exploitation are regarded as two incompatible processes which compete for scarce resources and exist in a state of tension. In characterizing the nature of the exploration-exploitation tension, March (1991) and other subsequent scholars contend that the two activities are inherently at odds, presenting a trade-off between exploration and exploitation. This conceptualizes exploration and exploitation as being diametrically opposed. In reviewing the conceptual treatment of the exploration-exploitation tension, Gupta et al (2006) note that in the case of this perspective, exploration and exploitation are deemed to be two ends of a continuum given that "the mindset and organizational routines needed for exploration are radically different from those needed for exploitation, making the simultaneous pursuit of both all but impossible" (p. 695). Hence, the logic implies that the simultaneous pursuit of exploration and exploitation requires an approach in which the two activities are managed mutually exclusively within or across domains (i.e. individual, subsystem, organizational unit). Levinthal and March (1993) contend the need for "sufficient exploitation to ensure [an organization's] current viability and, at the same time, devote sufficient attention to exploration in order to ensure the organization's future viability" (p. 105). This logic suggests that an appropriate level or degree of balance between exploration and exploitation is required and in equivalent magnitude (March, 1991). Lubatkin et al's (2006) study of ambidextrous performance in SMEs found organizations achieved high performance levels when the balance of exploration and exploitation were both at their highest levels. In addition, Uotila, Maula, Keil and Zahra (2009) hypothesize that "a balance between exploration and exploitation should provide optimal performance levels, and that such a balance involves trade-offs

between exploration and exploitation” (p. 228). And Lavie and Rosenkopf (2006) talk of striving for and maintaining balance across domains through different forms of alliances, where exploration and exploitation are relatively evenly represented. In Agostini, Nosella and Filippini (2016) recent study the writers define ambidexterity as simultaneously “achieving high levels” of the two activities of a tension (p. 129), thus implying the pursuit for similar optimal levels of exploration and exploitation.

However, some writers question the logic of ‘balance’ between the two ends of the continuum as being the optimum position, and suggest that the ideal position may not lie somewhere in the middle with a similar emphasis on both activities, but depends on the relative importance of exploration and exploitation activities to the organization (Gulati and Puranam, 2009); thus suggesting that it may in fact appear asymmetrical (Lee, Kim and Joshi, 2017). Interestingly, this draws parallels with Cao, Gedajlovic and Zhang’s (2009) empirical analysis of organizational ambidexterity and performance. In their initial hypothesis, they proposed that a high degree of balance between exploration and exploitation, where both activities were closely matched in magnitude, contributed to a positive effect on firm performance; however, they found little supporting evidence. Similarly, although He and Wong (2004) study found positive evidence supporting the ambidexterity hypothesis it also detected that when organizations pursue both strategies with equal aggression (i.e. rated highly on both exploration and exploitation), they encounter organizational difficulties which could negate the positive interaction effect, however, the authors do not go on to expand or detail this further. Moreover, it has been suggested that other factors such as environmental dynamism (Raisch and Birkinshaw, 2008) and organizational context (Gibson and Birkinshaw, 2004) are drivers that help determine an organization’s pursuit of either exploration or exploitation and its magnitude. Hence, this lack of agreement amongst researchers highlights knowledge gaps and questions around the character of the exploration-exploitation tension. If ambidexterity is to be attained by balancing two contradictory activities, then where the optimum point of ‘balance’ resides remains an issue of continuous debate. Is it the equal balance of the two or is it a normative judgement shaped by the organization’s context and the actors engaged in attaining ambidexterity?

### *Exploration-exploitation as interdependent complements*

Other researchers assume a different stance and suggest exploration and exploitation do not preclude each other. Although they concede them to be different and independent, they are not considered incongruous but rather complementary activities coexisting within an organization (Gibson and Birkinshaw, 2004; Gupta et al, 2006; Katila and Ahuja, 2002). This logic deems exploration-exploitation as orthogonal (Cao et al, 2009; Gupta et al, 2006; Putnam et al, 2016), thus organizations have the propensity to engage both activities in conjunction. This perspective reflects a continuous change process in which the pursuit of exploration does not negate the pursuit of exploitation and the two are mutually enhancing. Knott's (2002) mixed method analysis of Toyota's product development concludes that exploration and exploitation coexist as complements and within the same functioning unit, "since it is non-optimal to combine them if they are substitutes" (p. 340). Knott (2002) stresses the underlying mechanisms enabling the ideal combination of exploration and exploitation are significant to our understanding of how complementarity between these dimensions occurs. Likewise, Heracleous (2013) analysis of Apple Inc. highlights how the firm engages operational efficiency (exploitation) and serial innovation (exploration) simultaneously in what he calls a 'Quantum Strategy'. Heracleous shows that these two different activities exist in an integrative manner within the same organization and are not considered or treated as trade-offs constraining Apple's strategic choices but rather it drives their industry leading performance.

The idea holds that exploration and exploitation coexist within the same unit and can be managed in a complementary fashion implies organizational ambidexterity may be the result of an integrative approach to exploration and exploitation. And in Farjoun's (2010) theoretical review of stability and change, which he equates to exploitation and exploration respectively, he presents a duality view of the tension. Farjoun contends that "duality suggests instead that stability and change in different units and hierarchical levels may intertwine and depend on common practices and that rather than negating and displacing one another, they can mutually reinforce each other in a process of renewal" (2010: 218). Furthermore, Farjoun (2010) asserts that the duality view "casts doubts on organizations' ability to separate elements of stability and change so neatly" (p. 218), thus contesting the pragmatic viability of the dualistic assumption of tensions as diametric opposites.

### *Exploration-exploitation as interwoven paradoxes*

A third perspective pertinent to discussions surrounding the relationship between the exploration and exploitation tension has received growing attention in recent years; that of paradox (Raisch and Zimmermann, 2017; Smith and Lewis, 2011; Smith, Lewis, Jarzabkowski and Langley, 2017). Paradox, as defined by Schad, Lewis, Raisch and Smith (2016) refers to “persistent contradictions between interdependent elements. While seemingly distinct and oppositional these elements inform and define one another, tied in a web of eternal mutuality” (p. 6). Cameron (2017) explains that what distinguishes paradox from related concepts<sup>3</sup> is that the elements are simultaneously mutually exclusive and contradictory but also present and accepted. Some scholars contend that as a theoretical lens, paradox can extend our understanding of organizational tensions for it embraces principles of dynamism and complexity and spans contexts, levels of analysis and time both within as well as across organizations (Clegg et al, 2002; Smith and Lewis, 2011; Papachroni et al, 2014; Smith and Lewis, 2011; Schad et al, 2016). The versatility of the paradox perspective makes it applicable to a variety of phenomena, including organizational ambidexterity and the exploration-exploitation tension (Andriopoulos and Lewis, 2009; Papachroni et al, 2016). It has been argued that the continuum and orthogonal perspective of tensions give a simplistic view of polar constructs and emphasizes the need to go beyond such distinctions (Lewis, 2000). In emphasizing competing logics and their concurrent interdependence, the paradox lens can be seen as synthesizing the continuum and orthogonal perspectives for it maintains that tensions are distinct contradictory forces, but are simultaneously complementary. Westenholz (1999) conceptualization of paradox reflects on its composite nature purporting that “paradox is simultaneously ‘either/or’ and ‘both-and’”, a position she refers to as “both:: or” (p. 506). Hence, paradox can provide a more holistic understanding of organizational tensions and denotes a sense of continual motion in the nature of conflicting forces, a state Smith and Lewis (2011) refer to as ‘dynamic equilibrium’ (p. 392).

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<sup>3</sup> Cameron (2017) makes a distinction between paradox and related concepts including irony, ambivalence, dialectic, dilemma and inconsistency. Clegg and Pina e Cunha (2017) exposition provides an in-depth analysis of organizational dialectics, its points of difference and similarity with the concepts tension, paradox and dilemma.

Similarly, Cao et al (2009) deconstruct ambidexterity into two dimensions - the “balance dimension” and the “combined dimension” – a typology which can be seen to be reflective of the paradoxical state of ambidexterity for the authors recognize that though inconsistent, the exploration-exploitation tension simultaneously comprises elements of integration and separation, coexisting as “two sides of the same coin” (Lewis, 2000: 761). Within Andriopoulos and Lewis (2009) study of how new product design companies manage the exploration-exploitation tension, they identify what they refer to as three nested paradoxes of innovation. Their findings indicate that in managing these tensions organizational actors saw these conflicting elements as paradoxes that interacted and reinforced each other, occurring at multiple levels of the organization. They also highlight that, in relation to paradoxical tensions, the combined use of integration and differentiation tactics is central to the ambidextrous performance of these organizations.

In theorizing solutions on how to deal with paradox Poole and Van de Ven (1989) propose four analytical modes — ‘acceptance, spatial separation, temporal separation, and synthesis’ (p. 566-567) – and it can be said that these modes are mirrored in the prevailing antecedents to ambidexterity as purported in current literature. Researchers have also highlighted another response to paradox, that of transcendence (Bednarek, Paroutis and Sillince, 2017; Clegg and Cunha, 2017; Lewis, 2000). Bednarek et al (2017) explain that central to the concept of transcendence is “the notion of working through rather than resolving paradox” (p. 79) and that it “does not mean resolution through a tidy synthesis...the paradox persists but through this ‘higher level of abstraction’ (Lewis and Grimes, 1999, p. 2001) contradiction is not only accepted but enacted as something more workable” (p. 79). In examining responses to performing paradoxes Bednarek, et al (2017) expound upon the practice of transcending performing paradoxes and how it unfolds through discourse and the rhetorical practices of organizational actors (p. 79). The authors find that transcendence occurs as an dynamic ongoing oscillating process as opposed to being a static outcome, where paradox(es) are worked through continuously rather than being resolved or completely synthesized. Both continuity and change are important to the transcendence of paradoxes. Clegg and Cunha (2017) explain that transcendence looks not to resolve the tension but to sustain it, for neither dimension of the tension is neutralized but remains active in the organization.

## **Antecedents to organizational ambidexterity**

Ambidexterity research abounds with studies exploring how organizations can pursue exploration and exploitation simultaneously, although blind spots still persist in our understanding of this endeavor. One of these blind spots refers to the interrelations between the antecedents to ambidexterity (Raisch and Birkinshaw, 2008; Simsek et al, 2009). Although literature notes the equifinality of achieving ambidexterity (Andriopoulos and Lewis, 2009), studies analyzing the pathways to ambidexterity have typically assumed a single configuration (Agostini et al, 2016), and are dominated by three approaches – structural, behavioral and temporal/dynamic solutions (Simsek, 2009; Birkinshaw, Zimmermann and Raisch, 2016). Each antecedent is treated as a distinct solution and engages with either the structural or contextual features of an organization. Critically each of the antecedents to ambidexterity is underpinned by a particular conceptualization of the exploration-exploitation tension and contends that the panacea to achieving ambidexterity is dependent on one of two imperatives: the principle of separation or the principle of integration.

However, in Raisch and Birkinshaw (2008) comprehensive review of ambidexterity research the authors point out that upon closer examination the different paths to ambidexterity appear to be complementary and interconnected. Other scholars articulate similar sentiments (Agostini et al, 2016; Kauppila, 2010; Markides and Oyon, 2010; O'Reilly and Tushman, 2013), yet despite these claims research has given little explicit consideration to how the different approaches may interact during an organization's pursuit of ambidexterity. The following discusses the antecedents to ambidexterity as treated in current research. (See table 4 for conceptual summary of the antecedents and underlying principles to ambidexterity).

### **Principle of Separation**

The principle of separation is grounded in the view that exploration and exploitation are conflicting polar opposites of a tension and therefore must be managed and treated separately in order to alleviate the conflict. Scholars from this school of thought assert that the exploration-exploitation conflict is best managed by separating the organization's structural design. The use of structural design as a solution for ambidexterity is integral to two prevailing pathways advanced in literature



- the structural ambidexterity approach and the temporal/dynamic ambidexterity approach.

***Structural approach***

The structural ambidexterity approach is the prominent classical approach to ambidexterity in literature and has been the focus of multiple research studies (Turner et al, 2013). Rooted in Duncan's (1976) concept of dual structures, the structural approach maintains that ambidexterity is realized by segmenting an organization's structure into two different units. Each unit is focused on either exploration or exploitation and operates its own independent systems, subsystems, processes as well as possesses a culture relevant to its requirements (Benner and Tushman, 2003; Tushman and O'Reilly, 1996), so to lessen the conflict between these two supposedly contradictory elements. Tushman and O'Reilly (1996) proposed that this solution of structural ambidexterity allows conflicting activities to be pursued simultaneously, thus advocating ambidexterity by virtue of maintaining a degree of balance between exploration and exploitation. Critical to this solution is the simultaneity it engenders in pursuing exploration and exploitation within the same instance of time, but in doing so it provides a static interpretation of ambidexterity and the organization's structure. It suggests that the nature and relationship between exploration and exploitation remains in perpetual conflict and therefore the management of structural separation remains consistent across time.

<b>Principle of ambidexterity</b>	<b>Nature of exploration-exploitation tension</b>	<b>Organizational Mechanism</b>	<b>Strategic Implication for ambidexterity</b>
Separation	Exploration and exploitation are contradictory activities in a perpetual state of conflict and are managed independently	Independent <i>structural</i> systems, processes and sub-cultures  <i>Temporal</i> dynamics with cyclical switching over time	Strategy focuses on maintaining constant physical distinction between exploration and exploitation. Separation can occur across different periods in time, and also in the same instance
Integration	Exploration and exploitation coexist as constant complements	□ Internal <i>organizational context</i>  □ Ambidexterous <i>senior leadership</i>	Strategy centres on management building an organizational environment that enables individuals to decide how and when to perform explorative and exploitative activities. Dependent on people having the ability to fulfil both activities
Interwoven	Exploration and exploitation are paradoxical, fluid and interdependent, exist in a state of conflict and complementarity	□ <i>Mixture</i> of structural systems, processes, sub-cultures, and internal organizational context	No one single approach to ambidexterity but a complex amalgamated dynamic endeavour. Strategy interweaves structural principles and behavioural flexibility

Table 4: Conceptual summary of antecedents and underlying principles to ambidexterity

Consequently, this antecedent leaves little room for the possibility that the nature and relationship of the exploration-exploitation tension may change over time and, subsequently, the structural approach may not serve in the same capacity. Furthermore, Jansen et al (2009) note that this structural approach “establishes differences across organizational units in terms of mind-sets, time orientations, functions, and product/market domains” (p. 799), thus suggesting inconsistencies occur on multiple organizational levels as a result of structural differentiation including operational activities and strategies, and implicit features such as cognitive logic and norms. Extending the idea of inconsistencies arising from structural separation, Schad et al (2016) note that negative consequences may arise from this structural mode of operating which could possibly negate its benefits. The authors claim that “structural separation can help minimize conflict and avoid inertia, but can also create power imbalances, where one pole begins to dominate” (Schad et al, 2016: 28), which leaves questions in understanding the multivariate reasons underlying why one pole may dominate the other, the organizational imbalances that may arise and the impact of this on performance.

*Mechanisms enabling the structural approach*

With its emphasis on the separation of exploration and exploitation between distinct structural units, the structural approach has been criticized for not attending to the integration of exploration and exploitation. Scholars have argued that, although structure is capable of supporting the achievement of both exploration and exploitation, it is insufficient for effective ambidexterity (Gilbert, 2006; Turner et al, 2013) because an organization can generate value in recombining exploration and exploitation (Birkinshaw and Gibson, 2004; O’Reilly and Tushman, 2008). In light of this researchers propose that whilst exploration and exploitation should be loosely coupled at the unit level it is important that these differentiated units are integrated and tightly coupled together at corporate senior management level (Benner and Tushman 2003; Harreld et al, 2007). Integration they theorize is dependent upon and resides specifically with leadership at the top of the organization (O’Reilly and Tushman, 2008). O’Reilly and Tushman (2004) argue that “a company’s senior management team must be committed to operating ambidextrously even if its members aren’t ambidextrous” (p. 9), indicating that the functional capability and leadership processes of the senior team are a critical enabling feature for the effective

operation of the structural antecedent to ambidexterity. For this reason, senior management is regarded as an enabling mechanism whose coordination and integration of exploration and exploitation ensures the effective management and balance of both activities within an organization whose units are structurally separated (Lubatkin et al., 2006).

Researchers have also sought to identify other high-level mechanisms integrating exploration and exploitation within the context of structural ambidexterity. Jansen et al (2008) and O'Reilly and Tushman (2004) posit that a common vision can link differentiated units for it “[brings] together all employees in a common cause and preventing organizational separation from turning into organizational fragmentation” (O'Reilly and Tushman, 2004: 8). Arguably, this responsibility sits under the purview of the senior management team who must formulate and communicate the vision throughout the organization, thus relating to the significance of senior leadership in structural ambidexterity. Other academics have explored further cross-unit integrating mechanisms within a structurally separated context, identifying nurturing and sharing as significant factors (Raisch, 2008).

### ***Dynamic/temporal approach***

The dynamic/temporal ambidexterity approach has been referred to using several different terms such as cyclical ambidexterity (Simsek et al, 2009), punctuated equilibrium (Gupta et al., 2006), dynamic ambidexterity (Luger, Raisch and Schimmer, 2013), rhythmic switching (Brown and Eisenhardt, 1997), or organizational vacillation (Boumgarden et al, 2012; Kang, Kang, Kim, 2017). As with the structural approach, it is founded on the principle of separation, viewing exploration and exploitation as two conflicting elements where the pursuit of one precludes the other and occurs within the same organization or unit. However, its core focus is on the distinction of exploration and exploitation through time as opposed to structural differentiation occurring within the same instance. Despite its various labels, the dynamic/temporal approach refers to the sequential allocation of resources and structural shifts between periods of exploration and exploitation in a cyclical pattern over time; where exploitation is said to occur over long-periods of time punctuated by irregular short bursts of exploration (Romanelli and Tushman, 1994). However, Asif (2017) categorizes punctuated equilibrium as a process-related antecedent in that it “represents actions and behaviors that create ambidexterity” (p. 1491), and explains

that “the primary emphasis of temporal cycling is to change the deep structures developed and solidified during long-term exploitation through periodic bursts of exploration” (p. 1495), thus representing a dynamic capability.

In discussing the motivations for why an organization would incur the repeated disruptions to its structure and operations and undertake this temporal/dynamic approach of switching between exploration and exploitation, Raisch and Tushman (2016) outline three theoretical perspectives. Firstly, holding to contingency theory Raisch and Tushman (2016) suggest that organizations switch between exploration and exploitation as an adaptive response to changes in their environment. The second perspective deems the transitions as being part of an organization’s life-cycle and so periods in which exploration decreases and exploitation increases, and vice-versa, are a natural occurrence. Thirdly, Raisch and Tushman (2016) highlight the vacillation perspective, emphasizing that temporal separation between exploration and exploitation can dispel organizational inertia for it eliminates the conflicts which occur in the concurrent pursuit of both activities (Gulati and Puranam, 2009; Boumgarden et al, 2012). In contemplating the appropriateness of using the temporal approach with its oscillating sequencing, Rosenkopf and Nerkar (2001) argue that it would be more suited to stable environments and small organizations who lack access or the disposition to access plentiful resources, especially given that the oscillating process can be highly disruptive to an organization and frequent radical change would be difficult to maintain effectively. This raises questions as to the practical viability of such an approach especially in large and established organizations which are more susceptible to structural and cultural inertia.

#### *Mechanisms enabling temporal/ dynamic approach*

A core enabling feature of this approach is the act or practice of switching between exploration and exploitation which constitutes the dynamic motion characterizing this pathway to ambidexterity. This feature distinguishes it from the static structural and behavioral approaches to ambidexterity. Arguably, this dynamic trait gives credence to the concept of fluidity in the ambidexterity process, as opposed to ambidexterity being a fixed single state phenomena. This motion of cyclical switching back and forth between exploration and exploitation is the mechanism of balance, ensuring the failure traps of over-innovation and competency traps of exploitation are averted (Siggelkow and Levinthal, 2003).

Current research provides a limited understanding of the mechanisms that organizations use to enable temporal switching between exploration and exploitation (Stadler et al., 2014). Duncan (1976) proposes that ambidexterity is possible by switching between two structural forms: organic structures for initiating activities and mechanistic structures to implement them. Similarly, Brown and Eisenhardt's (1997) grounded study demonstrates how organizations switch from building on the past (exploit) to look to the future (explore) via what they term 'rhythmic time-paced transitions' and 'semi-structures', and are concepts which draw parallels with Klarner and Raisch (2013) sequential rhythmic shift patterns. Taking another view, Simsek et al (2009) suggest instituting conflict resolution systems are another enabling mechanism of temporal separation for it aids in resolving conflicts in managerial roles during the challenging transition periods. And Boumgarden et al (2012) argue that firms can change and switch between formal structures of exploration and exploitation more easily than adjust the culture and the informal organization.

Kang, Kang and Kim (2017) examination of vacillation between exploration and exploitation provides a somewhat different perspective of the transition by emphasizing a distinction between formal and informal organizational structures. The authors posit that "an ambidextrous organization emerges and then disappears during vacillation because changes in the formal structure are followed by lagged changes in the informal organization...As an informal organization for exploration gradually changes into an informal organization for exploitation and vice versa, the informal organization that is in transition temporally achieves the characteristics of both exploration and exploitation" (p. 1357). Hence, Kang et al (2017) suggest that during the transition from one dimension to another, whilst formal organizational elements are in a state of change, it is at this point that the informal organization temporally becomes the mechanism of ambidexterity and simultaneously operate exploration and exploitation. Kang and colleagues go on to explain that their study findings suggest that inertia is an enabling mechanism that supports the ambidextrous informal organization: "one benefit of inertia is that the temporarily emerging ambidextrous informal organization will retain the desirable ambidextrous characteristics longer for the organization with strong inertia...firms with weak inertia have to vacillate more frequently because their temporary ambidextrous informal organization will vanish more quickly" (p. 1357). However, Kang et al (2017) do not specify what constitutes

high or low inertia, or how one would determine if the boundary between high and low had been crossed.

Questions arise over the feasibility of the temporal/dynamic approach if structure and culture change at different rates. This presents a source of organizational misalignment which has the potential to inhibit change and adaptation towards ambidexterity rather than enable it. Furthermore, this approach assumes that an organization's management team possess the capabilities to proactively manage the different structural arrangements, administrative processes and systems, cultural orientations and mind-sets required for the effective transition between cycles (O'Reilly and Tushman, 2013).

### **Principle of Integration**

The principle of integration conceptualizes exploration and exploitation as complements coexisting harmoniously within the same organizational unit or system (Gibson and Birkinshaw, 2004). Within ambidexterity studies this view of exploration and exploitation is embodied in the behavioral approach to ambidexterity, rooted in organizational context and culture literature (Simsek et al., 2009). With the behavioral approach, attention shifts to “non-structural elements of ambidexterity such as culture and values, incentives, mind-sets and strategic foresight” (Markides and Chu, 2009: 325), signifying a multidimensional component to pursuing ambidexterity. Academic discussions on the behavioral dimension to ambidexterity generally orientate around two levels of analysis: (1) the organizational level focuses on the wider internal context, and (2) the individual level, refers to the behavior and competencies of individuals and groups/teams.

#### ***Behavioral approach: Organizational level***

At an organizational level, the behavioral approach suggests that the concurrent pursuit of exploration and exploitation within an organization/unit stems from cultivating an environment that engenders the behaviors conducive to accomplishing ambidexterity. Gibson and Birkinshaw (2004) first proposed the behavioral capacity as an alternative way of creating the capabilities needed for ambidexterity. Gibson and Birkinshaw (2004) peer at ambidexterity through the lens

of the adaptability-alignment tension<sup>4</sup> and develop the concept of *contextual ambidexterity*. Contextual ambidexterity emphasizes an organization's context and refers to its systems and processes which interact to facilitate alignment (exploitation) and adaptability (exploration) simultaneously across the whole business unit (Gibson and Birkinshaw, 2004a; Lee, Kim and Joshi, 2017). Gibson and Birkinshaw (2004a) describe that an ambidextrous context is built to be dynamic and flexible, and manifests in the behavior and actions of organizational actors. They go on to contend that "ambidexterity is best achieved *not* through structural, task, or temporal separation, but by building a business-unit context that encourages individuals to make their own judgments" (2004a: 211, emphasis added). Markides and Chu (2009) investigation into how corporate parent companies with diversified firms become ambidextrous found that several non-structural solutions promoted ambidexterity, thus concluding that structure is but one of the elements of the organizational 'context' underpinning ambidexterity.

An individual's capacity to decide how they allocate their time between adaptability and alignment orientated activities is a central feature of contextual ambidexterity, made possible by the organization's internal environment developed to shape this behavior at every level of the hierarchy. Consequently, contextual ambidexterity implicitly assumes that organizational actors at all levels of the hierarchy understand the ambidextrous strategy and that the strategy translates universally across the whole organization and is homogeneously understood by all employees. However, this claim would appear to make broad assumptions on the motivations and individual capabilities of all workers. It does not fully acknowledge the complex challenges that this ambidextrous ideal places on a person's intellectual, social and physical capacity (Holmqvist and Spicer, 2013), or that it may not be achievable by all people.

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<sup>4</sup> Birkinshaw and Gibson (2004a, 2004b) define each of the elements in the adaptability-alignment tension. Adaptability is referred to as "the ability to move quickly toward new opportunities, to adjust to volatile markets and to avoid complacency" (2004a: 47) and also say that it focuses "on the future. It is the ability to respond to change, to be nimble, to progress" (2004b: 5). Its diametrically opposed but equally important capability, alignment is "a clear sense of how value is being created in the short term and how activities should be coordinated and streamlined to deliver that value" (2004a: 47) where it centers on "maximizing the present, leveraging existing ideas, exploiting markets" (2004b: 5). Arguably the adaptability-alignment tension resembles the exploration-exploitation tension for adaptability orientates around flexibility and innovation, traits shared with exploration, whilst alignment concerns the maximization and efficient utilization of current capabilities, existing products and markets, which is akin to exploitation. Therefore, this paper views and uses the terms adaptability and alignment to be interchangeable with exploration and exploitation.



Papachroni et al (2014) provide an interesting alternative perspective to contextual ambidexterity perceiving it as a form of temporal ambidexterity. The authors contest that "...the concept of contextual ambidexterity itself relies on a form of temporal separation at the individual level" (Papachroni et al, 2014: 8), thus suggesting that ambidexterity results from the very act of switching rather than the context itself. Furthermore, proponents of the contextual ambidexterity approach place the onus on senior management as the ones who create the context that enables and encourages staff members to use their own judgement in deciding how to divide their time between exploration and exploitation activities (Gibson and Birkinshaw, 2004). Gibson and Birkinshaw (2004) do not specify how it should be implemented, but do admit that there are likely to be costs involved in implementing systems and processes to achieve contextual ambidexterity. The authors do however contend that the costs of this approach may be cheaper than the traditional structural solution as costs only account to controlling and supervising employees, but the authors do not expound on the magnitude or nature of such costs.

Furthermore, Kauppila (2010) point to further drawbacks in Gibson and Birkinshaw's (2004) rendition of contextual ambidexterity in relation to its treatment of explorative and exploitative knowledge and how it is developed and used ambidextrously. Kauppila (2010) explains that "a shortcoming of the contextual ambidexterity model is that it does not consider how a firm can simultaneously conduct radical forms of exploration and exploitation. Rather it merely assumes that explorative knowledge is produced somewhere and that it is then selectively adapted to the organization's purposes. Furthermore, the contextual model assumes that a firm exploits the knowledge that it has aligned, but does not explicate how this exploitation is organized" (p. 286).

*Mechanisms enabling behavioral approach: organizational level*

Drawing on Ghoshal and Barlett (1994) dimensions of organizational context, Gibson and Birkinshaw (2004) contend that ambidexterity is generated by creating a high-performing environment in which hard organizational attributes of stretch and discipline are combined with soft features of support and trust. The authors argue that these four features are integral to contextual ambidexterity characterizing them as "interdependent, complementary features of organization context that are non-

substitutable, and therefore all four must be present in order for a business unit to become ambidextrous” (p. 214). However, this begs the question as to whether these four attributes alone are sufficient in enabling ambidexterity, and what other features or mechanisms of an organization’s context presently unidentified in ambidexterity literature may contribute in an organization becoming ambidextrous?

In Adler, Goldoftas and Levine’s (1999) study of Toyota’s production system the authors identify meta-routines and job enrichment as mechanisms that allowed employees to decide for themselves how to reconcile the efficiency-flexibility tension, and point to training and trust as two critical supporting contextual factors guiding the effectiveness of these mechanisms. It could be argued that Adler et al’s (1999) meta-routines and job enrichment mechanisms are reflective of Birkinshaw and Gibson (2004) performance management dimension for it stimulates people to behave in a manner conducive to achieving ambidexterity by providing systems in which to operate. Likewise, Adler et al (1999) concept of training and trust reflects the social support context (Birkinshaw and Gibson, 2004) providing people with the scope and license in which to make their own decisions on how to operate efficiently and flexibly. In another vein, Birkinshaw, Zimmermann and Raisch (2016) illustrative case study of GSK highlights how the organization’s vision, culture and people development enabled behavioral integration to balance scientific innovation and a commercial orientation. The authors explain how GSK created a vision that united and promoted innovation and commercial entrepreneurship throughout the organization. And had a culture focused on shifting mind-sets by employing cross-functional teams and cultural principles of transparency, mutual learning, and support (Birkinshaw et al, 2016).

Focusing on contextual ambidexterity, Turner and Lee (2012) examine human capital, social capital and organizational capital as mechanisms for ambidextrous exchange which interact in complex work structures revealing “the multiplicity of resources enabling ambidexterity, and the complexities of their interactions not only with each other but also with the processes of exploitation and exploration” (p. 192). In terms of people development Birkinshaw et al (2016) note that front line managers with blended skills were hired to sense and seize entrepreneurial opportunities whilst senior executives were responsible for shaping and reconfiguring the context in which exploration and exploitation could occur simultaneously. Additionally, Bierly and Daly

(2007) highlight team-based structures and human resource practices as organizational systems which support the simultaneous pursuit of exploration and exploitation.

Arguably, contextual ambidexterity describes the conditions an organization should have to become ambidextrous but this does not necessarily explain or detail what organizational features a firm should change in order to build that environment, or how organizational leaders can promote new cultures that accommodate exploration and exploitation (O'Reilly and Tushman, 2013).

***Behavioral approach: Individual-level***

Ambidexterity scholars have also looked at the behavioral approach to ambidexterity at the individual level, emphasizing the integrative abilities of an individual to adjust between exploration and exploitation rather than the corporate context and culture of a unit (Simsek et al, 2009). At the individual level, the ability to successfully contend with and adjust between exploration and exploitation demonstrates cognitive and behavioral complexity (Smith, Binns and Tushman, 2010) - where cognitive complexity is defined as “the ability to seek integration across seemingly contradictory tensions” and behavioral complexity, “the ability to engage multiple leadership behaviors that may seem in conflict with one another” (Smith et al, 2010: 458) - constitutes a highly challenging mental balancing act, but successful leaders are able to demonstrate both (O'Reilly and Tushman, 2004).

Within extant literature individual level ambidexterity is judged a managerial capability and studies have examined senior leaders (O'Reilly and Tushman, 2004; Smith, 2014; Smith and Tushman, 2005), and top management teams (Jansen and George, 2008; Lubatkin, Simsek, Ling and Veiga, 2006), general managers and middle managers (Burgess, Strauss, Currie and Wood, 2015; Fiol, 2002; Lüscher and Lewis, 2008; Taylor and Helfat, 2009) and front-line staff (Groysberg and Lee, 2009). Senior management has been the primary research focus of individual level ambidexterity. O'Reilly and Tushman (2008) advise that “ambidexterity is a specific capability embodied in senior leadership’s learning and is expressed through their ability to reconfigure existing organizational assets and competencies in a repeatable way to adapt to changing circumstances” (p. 200), a leadership ability that confers dynamic capabilities (O'Reilly and Tushman (2008). However, how top management actually do this and manage the conflicts requires further exploration (O'Reilly and Tushman, 2013).

In highlighting the critical role of senior leadership teams for ambidexterity, Smith et al (2010) highlight building commitment to an overarching vision and goals, active learning behaviors at various levels, the direct engagement and management of conflicting tensions, dynamic pattern of decision-making and leadership team structures as characteristics necessary for senior management's successful management of organizational tensions. For instance, Smith (2014) found that top management teams effectively managed exploration and exploitation over time through dynamic decision-making which adopted and combined practices of differentiating—pulling apart the poles to amplify their valued distinctions—and integrating—accentuating their linkages to leverage synergies. Doing so allowed them to frequently oscillate support between the existing product and the innovation, such that both flourished simultaneously. Whilst Jansen, Vera and Crossan (2009) found exploratory innovation was associated with transformational leadership and exploitation with transactional leadership.

Some proponents contend that top management teams are essential and needed to ensure integration across the different units (Tushman and O'Reilly, 1996; Smith and Tushman, 2005) and strategizing how the tension is translated downwards throughout the organization. Binns, Smith and Tushman (2010) imply that senior managers are critical and responsible for translating the contradictory complexity down to their middle managers. With paradoxical complexity held at the top, this view concludes that the role of middle managers is to focus on executing the strategy, perceiving them to be the ones who “support and implement the strategies and business models, but who have no direct influence on deciding on them” (Binns et al, 2010: 458). This poses the question as to whether senior leaders are capable of translating complex tensions down to lower-levels of the hierarchy and what this would look like.

Other scholars suggest ambidextrous organizations use lower-level integration mechanisms, such as middle managers and frontline staff, to stimulate lateral knowledge flows across units (Gilbert, 2006; Raisch, 2008). The role of middle managers in ambidexterity has received less attention than senior management, yet Van der Borgh, de Jong and Nijssen (2015) acknowledge the importance in exploring the role of middle managers in ambidexterity. Burgess et al (2015) highlight the significance of middle managers due to their role as mediators whose middle position in the organization enables them to adjust strategy (Floyd and Woodridge, 2000), and

span organizational boundaries and functions as organizational connectors (Taylor and Helfat, 2009; Wooldridge et al, 2008). Burgess et al (2015) focus on ‘hybrid’ middle managers “which represent professional workers [...] who hold managerial as well as professional responsibility” and “are uniquely placed to forge workable compromises between knowledge exploration and exploitation” (p. S88). Burgess et al (2015) found the professional orientation and ability to develop appropriate social connections facilitated organizational ambidexterity for hybrid middle managers. Relatedly, in the context of technological transitions, Taylor and Helfat (2009) focus on middle managers as critical organizational connectors who through specific actions play a key role in implementing and maintaining organizational linkages between disparate elements. However, the authors explain that it is top management who specify the necessary linkages by instructing lower-level managers and shape the behaviors of middle managers by influencing economic incentives, social context, structural design and shared organizational cognition to encourage (or discourage) ambidexterity.

Zimmermann and his colleagues (2015) provide a complementary view and identify the role of front-line managers in managing contradictory complexity of tensions as initiators of ambidexterity, where the management of complexity arises from the bottom up-rather than the top-down, as traditionally purported by structural ambidexterity. This resembles Smets, Jarzabkowski, Burke, and Spee (2015) study highlighting that the complexity inherent in organizational tensions is not restricted to the senior leadership level but is experienced by middle managers and employees in their everyday work practices. It implies that the pragmatic identification and management of tensions may extend beyond the remit of leadership. Groysberg and Lee (2009) contrast the performance of star performing front-line professional service analysts hired to explore versus those hired to exploit. The authors found that the individual’s internal social capital and support structure (i.e. colleagues) affects the new hires performance where those hired to exploit existing capabilities of established markets performed better than those hired to explore a market new to them and their employers. This was due to a lack of established capabilities and competent knowledge in the new sector. It indicates the significant role played by historical learning and capability development at the individual, as well as firm level, in shaping and enabling the effective pursuit of ambidexterity at the individual and even firm level.

Jansen et al (2009) give an individual level analysis of how formal and informal mechanisms at senior team level mediate the relationship between structural

differentiation and ambidexterity. Integration, they found, depicts hierarchical levels with social and formal integration across senior team members encouraging corporate level ambidexterity. At lower levels, ambidexterity is found to be achieved through more formal cross-functional interfaces. This insight also draws some parallels with Kang et al (2017) in showing how both formality and informality are required in some balance to achieve ambidexterity, and this can be part of the organizational structure as well as process design.

### **Principle of Paradox**

#### ***Interrelations between antecedents to ambidexterity***

Despite increasing interest in ambidexterity, antecedents to becoming ambidextrous have largely been studied and conceptualized as distinct and even static forms, bar temporal/dynamic ambidexterity, thus supposing them to be standalone configurations. However, few scholars have observed that complementarities exist between the different pathways to ambidexterity (Agostini et al, 2016; Birkinshaw and Gibson, 2013, Kauppila, 2010; Raisch and Birkinshaw, 2008), suggesting an alternative perspective that accounts for the complexity inherent in the ambidexterity process. However, researchers have not fully defined or expanded upon the details of this complementarity or how it may be embodied operationally. For instance, within O'Reilly and Tushman's (2013) review of ambidexterity literature the authors submit that the pursuit of ambidexterity requires a mixture of contextual and structural approaches but do not expand upon such a composition in-depth. And Agostini et al (2016) affirm that "an ambidextrous organization is achieved through the coexistence of structural and contextual issues and managers' roles, which appear to be strictly interlinked, whereas previous literature has mainly investigated only one single solution that usually does not provide the exhaustive functionalities required to deal with the entire range of boundary conditions and tensions faced by an organization over time" (p. 131).

Raisch and Birkinshaw's (2008) conceptual analysis cites commonality between enabling elements of structural and contextual ambidexterity, noting that the former requires a unitary overarching vision and culture, leadership capable of managing tensions and managers adaptable to implementing the strategy (Tushman and O'Reilly, 1996; O'Reilly and Tushman, 2008); and vice-versa, with an organization's structure, systems and processes (Gibson and Birkinshaw, 2004) being explicitly referenced for

contextual ambidexterity. Similarly, Cao et al (2009: 782) conceptualize two dimensions which they claim encompass ambidexterity – the “balance dimension” and the “combined dimension” - are distinct but related, and conclude that in simultaneously pursuing both dimensions the organization gains a positive enhancing effect on ambidextrous performance: “That is, we expect that, when combined, the two dimensions of ambidexterity [balance dimension and combined dimension] will have a synergistic effect on firm performance” (p. 784). In other words, the authors contend that the combined engagement of separation mechanisms (balanced dimension) along with integrative mechanisms (combined dimension) generated effective ambidexterity. However, the study falls short of explaining how an organization may combine these two different dimensions to gain the synergistic effect. In addition, Kauppila’s (2010) study of inter- and intra-organizational approaches to ambidexterity concludes that these two structural approaches are complementary rather than substitutes, which leads to the suggestion that there may be other complementary aspects to the different pathways to ambidexterity.

In-depth studies have begun to emerge helping to illustrate how firms may engage different antecedents to manage organizational tensions and operate ambidextrously within an inter-firm context. Lavie and Rosenkpf (2006) examination of U.S. software companies suggests that firms use alliances to balance exploration and exploitation over time and across domains, and are able to deploy both ambidextrous strategies (exploration and exploitation at the same time) and punctuated equilibrium strategies (switching between exploration and exploitation across time). In another inter-firm study Raisch and Tushman (2016) comparative case analysis focuses on the parent-subsidy business model and examines how the inter-firm relationship evolves as the subsidy units scale up. The study found that large incumbent firms set up separate new explorative business units outside their core business which were structurally differentiated from its horizontal counterpart in the core business but maintained a degree of vertical integration with the core firm’s management team. The subsidy units were later scaled up as their focus shifted to exploitation of their capabilities by switching to integrated mechanisms having achieved political and economic legitimacy. Interestingly, the authors delineate time and the scale up process into phases – exploration, the scale up transition and exploitation phase – which can be seen to be reflective of the temporal/dynamic ambidexterity sequence. The study provides insights into how inter-firm relations

modify over time and engage with differentiation and integration mechanisms at different levels and can be viewed as a macro representation of O'Reilly and Tushman's (2011; 2013) concept of targeted integration. Nonetheless, it does not explain whether this inter-firm dynamic translates to ambidexterity within an intra-firm context. And given that the study's focal subsidiaries employed a focus strategy in dealing with exploration-exploitation activities (i.e. initially focused on exploration and then shifted to exploitation), it does not fully extend to understanding how an organization may manage the pursuit of both exploration-exploitation at the same time when bounded with the same firm.

Other studies provide an intra-firm analytical perspective of how different antecedents to ambidexterity may be employed in an interrelated fashion. Adler et al. (1999) rich description of Toyota's production unit gives insights into how multiple contextual mechanisms were employed to accommodate the dual forces of flexibility and efficiency. The authors describe how certain cultural mechanisms, structural partitioning and the sequential switching of employee roles were deployed to resolve the efficiency-flexibility paradox. Arguably this study gives credence to the view that different antecedents of ambidexterity can and are integrated within an organization. However, the study gives little insight into whether organizational tensions shift over time and how this may influence the pathway and transition to ambidexterity. In a one-year ethnography on work practices Smets et al. (2015) detail how reinsurance traders face tensions in exercising market and community logics by engaging in differentiation and integrating mechanisms. Differentiation involves segmenting spaces, times, and practices to address each logic, while integrating efforts, such as collaborative spaces and strategic problem solving, served to bridge the different logics so they inform and enable one another.

Interestingly, Andriopoulos and Lewis' (2009) multi-case study looks at how the exploration-exploitation tension is managed in ambidextrous firms through a paradox perspective. Their findings reveal that firms manage the tension using a blended mix of integration practices such as cultivating a paradoxical vision, purposefully improvising, and socializing employees; and differentiation tactics including diversifying product portfolios, iterating between project constraints and freedom, and separating work modes to manage the exploration-exploitation paradox. The blending of both tactics was found to be vital in stimulating the virtuous cycles of ambidexterity. Andriopoulos and Lewis (2009) conclude that firms need to manage



the paradox at multiple levels and that their interactions across levels reinforces ambidextrous practices. Nevertheless, the study focuses on firms who due to the character of the product design industry, are designed with an ambidextrous intent from their inception. As such it gives little insight into the nature of change for an organization for whom the strategic pursuit of ambidexterity occurs later on in its lifecycle as a result of neoteric changes in its internal and/or external environment. How do these different antecedents to ambidexterity interact, why do these interactions occur and what is the resulting consequence of these interactions?

Considering the above, implicitly, ambidexterity studies can be seen to assume that firms adopt and change their differentiation-integration activities in line with changes in their needs for exploration and exploitation (Raisch and Tushman, 2016), and the nature of the market in which they operate. “For example, a simultaneous approach may be more appropriate in dynamic markets where conditions are changing while in more stable environments firms may be able to afford a sequential approach. Contextual ambidexterity within a business unit may promote the local innovation and change needed to continually adapt to small changes in the environment [...]. It appears that structural ambidexterity is crucial in creating the context where incumbent firms can explore in the context of their existing strategy and history. However, once the exploratory units gain traction, firms may take advantage of this capability by switching into more integrated structures” (O’Reilly and Tushman, 2013: 330). Such a suggestion implies a contingency paradigm to understanding the complexities of an organization’s pursuit for ambidexterity. O’Reilly and Tushman (2013) also note that time, in a historical sense, may be a critical feature on which ambidexterity is contingent upon; however, the shaping influence of organizational history on the pathway to ambidexterity needs further empirical exploration. Van der Borgh, de Jong and Nijssen (2015) empirical analysis of exploitative and explorative selling amongst front-line salespeople provides evidence that both structural and situational mechanisms (i.e. overarching vision) play an important role in driving ambidextrous performance in individuals (salespeople). Similarly, Agostini et al’s (2016) statistical analysis finds support for integrating structure and context in order to align exploration and exploitation for innovation ambidexterity. The authors identify three underlying mechanisms – structural ambidexterity, social support and performance management – as enablers of ambidexterity.

Although ambidexterity literature is rich in insights and conceptualizations on the possible pathways and approaches to attaining ambidexterity, the succeeding study contained within this paper hopes to address some of the intra-firm ambidexterity gaps highlighted above. It seeks to explore how the various structural, contextual and individual level mechanisms may be employed in a combined manner within an organizational unit as it seeks to become ambidextrous. The following section discusses the methodological approach employed for this study.

## **RESEARCH CONTEXT AND METHODS**

This study adopts an inductive, grounded-theory building approach (Glaser and Strauss 1967) by employing an in-depth case study of a large unit within an organization and their transition experience towards effectively operating science innovation (exploration) and engineering excellence (exploitation). In so doing, the study aims to advance our understanding of how structural, contextual and individual level antecedents may be engaged and interconnected, and explore the mechanisms and impediments influencing this transition. Consequently, the single case study approach allows the researcher to look in detail at how the unit's management of the exploration-exploitation tension evolves and also probe as to why it evolves and the selected antecedents during this process. In so doing it assumes a longitudinal perspective of the unit's development from its initiation through to contemporary events, and the internal mechanisms and impediments as it transitions to efficaciously manage dimensions of an organizational tension. This follows in the vein of inductive in-depth case studies examining the approaches and mechanisms engaged in managing dimensions of organizational tensions (Adler et al, 1999; Harreld, et al, 2007; Heracleous et al, 2016; Jarzabkowski, Lê and Feldman, 2012; Raisch, 2008). Inductive case studies are suitable for addressing 'how' and 'why' research questions and are particularly useful for developing theory on how complex organizational processes unfold over time (Eisenhardt, 1989; Yin, 2009). Yin (2009) would suggest that this reflects an explanatory case dealing with 'operational links that need to be traced over time, rather than frequencies or incidences' (p. 9).

## Research Context

The study's empirical setting is a notable and sizeable organizational unit in operation at the Johnson Space Center (JSC) – namely the International Space Station (ISS) program. The ISS program is the largest unit in terms of budgetary funding and resources, is one of NASA's major space programs and reports directly to NASA headquarters in Washington, DC. JSC is NASA's Mission Control center for all manned space missions, and the primary control facility for the orbiting U.S. segment of the International Space Station (ISS). Prior to the ISS program, JSC had been the operational center for all NASA Space Shuttle missions up until the program's termination in November 2011. On the 25<sup>th</sup> January 1984, President Ronald Regan directed NASA to construct a permanently occupied space station “and to do it within a decade” in cooperation with the international community<sup>5</sup>. Development of the ISS begun in 1994 after much political tumult with a change in Administration, four rounds of design iterations and cost overruns in the region of \$8 billion which undermined NASA's budget credibility and lead to waning support from politicians for the ‘mega-project’ with multiple Congressional attempts to end the space station program (H.R.4451 Bill, 1993) (see appendix C for list of Congressional attempts to terminate the ISS Program). The ISS was a complex endeavor which took 13 years to assemble (November 1998- May 2011), required over 30 Shuttle missions and came about as a result of international engineering and scientific collaboration across five space agencies. With an estimated cost of \$150 billion, the ISS Program is arguably the largest in size and complexity that NASA has ever undertaken owing to the challenge of integrating various systems developed and provided by the different international space partners (NASA Taskforce, 2001). The ISS is a low-earth-orbit (LEO) microgravity laboratory orbiting 220 miles over the Earth, and provides a research environment unavailable on Earth for multidisciplinary scientific research and discovery. Throughout its evolution the ISS program faced a number of pressures including significant cost growth, schedule issues, numerous design iterations and scope scale-backs, five changes in government administration coupled with periods of

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<sup>5</sup> Development and assembly of the ISS was the direct result of unprecedented international collaboration spanning over twenty years between five space agencies – the United States National Aeronautics and Space Administration (NASA), Russia's Space Agency (Roscosmos), Japan Aerospace Exploration Agency (JAXA), Canadian Space Agency and the European Space Agency (ESA).

diminishing political support; all of which threatened the continuation of the program (NASA History, 2001)<sup>6</sup>. However, the program faced a challenge in pursuing exploration and exploitation simultaneously and effectively, an issue which came to a head when the space station platform was completed in 2011. The ISS program needed to adapt if it was to pursue exploration and exploitation activities simultaneously and effectively and so embarked on a change initiative known as RISE (Revolutionize the ISS for Science and Exploration). The program's evolution involved the concurrent engagement of structural, contextual and individual level mechanisms which provides insights to help expand our understanding of how the antecedents to achieving organizational ambidexterity are engaged within practice.

### **Research Methods**

To understand how the ISS program engaged with structural, contextual and individual level antecedents concurrently, and the mechanisms and impediments influencing this transition I conducted a qualitative study involving approximately 82 onsite interviews between August 2014 and September 2015. Data collection occurred in four phases<sup>7</sup> and it was during phase four, as a result of informal social interactions, that I gained knowledge of the ISS program's strategic change program and pursued this avenue further and in greater depth. A number of these interviews took place with informants who had been or were at that moment highly integrated into the ISS program and therefore had intimate knowledge of the program's internal mechanisms and organizational development and transition. Interviewees came from different levels – ground level, middle managers and management - and functions of the program, including the RISE change team, science innovation, and program routine operations. Each interview provided a slightly different perspective of the ISS program's development and incorporating these views and experiences served to enrich the data, and contributed to establishing a fuller understanding of the phenomenon from those involved. During the course of the interviews, informants who had worked on the program side of the organization provided retrospective accounts of the ISS program and their experiences working in the unit, and how it had

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<sup>6</sup> Marcia S. Smith (2001). Testimony before the House Science Committee. Congressional Research Service

<sup>7</sup> Refer to 'Methodological overview' in chapter one of this thesis for details of the four phases of data collection.

operated structurally and culturally, which helped establish greater empirical contextualization (Ketokivi and Mantere's, 2010). Interviews were semi-structured and lasted between 30 minutes to approximately 150 minutes, with key informants being interviewed at greater length. Interviews were recorded with informant permission and transcribed for analysis. Twelve participants did not wish to have their interviews recorded and therefore the researcher took detailed notes with the informants' permission and developed write-ups of the conversation. Data collection occurred in four phases which allowed the researcher to conduct follow-up interviews and probe interviewees. Interviews served to be a critical data source for this study.

To supplement the interview data, I also collected and examined internal ISS program documents including internal management presentations, program charts, internal communication materials and press releases, and review reports of milestones in the program's history. In addition, published reports on the ISS program's developmental progress, and archival transcripts of key ISS program individuals were also collected in order to gain a deeper understanding of the ISS program's formative years and method of operating. I also had the opportunity to directly observe a private meeting and attend an industry conference in which senior ISS program members spoke explicitly of the ISS program's change initiative, RISE, and how it underpinned their transition and the simultaneous operation of science innovation (exploration) and engineering excellence (exploitation). Combining multiple sources of data for analysis facilitated triangulation and contributed to validating the data and emerging analytical concepts.

### **Data Analysis**

Qualitative research data analysis “manages words, language, and the meanings these imply” and has the “capacity to create rich descriptions and understandings of social life” (Walker and Myrick, 2006: 549). Thus, in analyzing the qualitative data gathered during this project I employed an inductive grounded approach to theory generation derived from raw empirical data (Walker and Myrick, 2006). A grounded approach can be seen as an organic process to theory building that centers on establishing a good fit on three levels – (1) fit between the raw data and theoretical categories identified by the research, (2) degree to which the theoretical categories fit and explain interpretations of the reality, and (3) whether the theoretical categories fit

and are relevant in explaining the core phenomenon being observed (Suddaby, 2006). This approach of overlapping data collection and analysis provided flexibility in the iterative data collection process, allowing for adjustments to be made during the data collection process. These adjustments allowed the researcher to probe emergent themes or to take advantage of special opportunities which arise in a given situation (Eisenhardt, 1989). So, as new data collection opportunities arose I was able to take advantage by altering my data collection process and this flexibility enabled me to develop new theoretical insights.

Whilst conducting a series of interviews with participants I detected that the ISS program and the RISE initiative came up repeatedly, and constant comparison of first-order codes across the data confirmed this impression. From initial coding and interpretation of patterns it became apparent from the recurring frequency by which the topic was coming up that this could be a significant avenue for research and would require further investigation. This discovery directed subsequent data collection in interview protocol – such as the type of questions posed to interviewees. Interview questions focused on understanding the history of the ISS program, the nature of the new strategy, the intentions of the strategic change initiative, how it had come about, its performance outcomes and the challenges/obstacles encountered.

Further analysis guided me to expand the investigation. Interview data provided retrospective insights which gave further direction that analysis of the program's history was required. To analyze the data I initially employed within-case analysis (Eisenhardt, 1989) where I wrote a descriptive detailed case-study based on data gathered from the various interviews, analysis of documents and observations. The descriptive case was modified following the progressive collection of data to ensure new data was integrated, and the case reflected accurate information. This process was central to generating early insights into the case and helped the researcher become more familiar with the details of the case study. It also helped me to decipher some of the main themes and manage the volume of data collected. Furthermore, the within-case analysis allowed the researcher to identify preliminary emerging patterns which later contributed to analysis and the development of theoretical concepts.

Whilst coding I moved back and forth between inductive and deductive thinking and this interplay grounded my theory in the data (Strauss and Corbin, 1990). Alongside analyzing the data and building emergent concepts, I continuously referred back to the extant literature to find points of similarity as well as areas of differences

and explored the underlying reasons for this. Linking the findings to the literature was also important to establish internal validity, generalizability and in building theory from the case research (Eisenhardt, 1989). I also developed field notes scribing my personal thoughts and ideas of what was occurring in my analysis of the research as a way of combining data collection and ongoing analysis of the data (Van Mannen, 1987; Eisenhardt, 1989).

Having established the first-order codes and initial themes I formed categories from related codes. I then looked for relationships among the categories, and as codes and categories were adjusted through the process of analytical iteration, so the relationships between categories and sub themes were also adjusted. Finding relationships and connections between the different categories can be seen to reflect Strauss and Corbin's (1990) second phase of analysis, axial coding. Following this activity, I developed higher-order theoretical dimensions grounded in the categories, sub-themes and extant theory to further enable theory building and generalization. Table 5 below, is a table of the conceptual framework, core concepts and related concepts (Danneels, 2010) generated from the empirical data.

## **FINDINGS AND ANALYSIS**

The study finds that the exploration-exploitation tension can exist in a continual state of flux where both activities are all together active, but in varying degrees. The simultaneous pursuit of exploration and exploitation was found to evolve through a hybrid layered approach combining structural, contextual and dynamic antecedents, for which middle management were found to be a critical context-reshaping mechanism in embedding effective ambidextrous performance. The analysis consists of three broad core concepts each of which address a feature critical to understanding organizational ambidexterity and its manifestation in practice. Firstly, it examines the nature of the exploration-exploitation tension as experienced in practice by the organizational unit, the ISS Program. The study identifies that exploration-exploitation can coexist in a state of flux where the dominant emphasis shifts towards one element but does not negate the operative presence of the other. The underlying factors facilitating the fluctuating character were found to gives rise to the second core concept, the evolving hybrid approach to ambidexterity. The data shows how different

antecedents to ambidexterity, were progressively employed conjointly. Thirdly, the analysis identifies dynamic managerial capabilities as a feature exhibited by middle managers, and how they engage this capability to reshape the organization's context to enable effective ambidextrous performance. The analysis provides supporting evidence that the pathway to organizational ambidexterity is complex, multidimensional and evolves over time. In practice, it is found to result from the integration of different approaches (antecedents) to ambidexterity and is underpinned by a fluctuating exploration-exploitation tension. The analysis also emphasizes the role and significance of middle managers in crafting strategy and exercising dynamic managerial capabilities, and the role of unconventional organizational structures and practices in shaping a hybrid organizational context to enable ambidexterity.

### **1. Fluctuating emphasis between exploration and exploitation dimensions**

In analyzing the ISS program and its handling of the exploration-exploitation tension throughout its history, the data indicates that the nature of the tension is not static nor are exploration and exploitation activities pursued to the same magnitude or degree over time, but rather appear asymmetric (Lee, Kim and Joshi, 2017). The tension shifts from being in a state of conflict where the activities were managed separately to be reconciled and managed as integrated, complimentary features. The study found that the exploration-exploitation tension persisted throughout the development and operationalization of the ISS for it was inherent in the program's vision – to enable research by building a platform that exploited existing knowledge and technical capabilities. Both exploration and exploitation were active and present at the same time, however the magnitude and degree of emphasis and focus is found to be dynamic, fluctuating between exploration and exploitation and across strategic and operational factors. The study found that the shifting emphasis occurred as a result of changing priorities driven by the external environment, and cognitive and behavioral mechanisms internal to the program. As illustrated in the section below, we see a fluctuating emphasis between exploration and exploitation arose inside the ISS program because of three different but interrelated factors: (1) contrasting, inter-reliant capabilities and mode of operating, (2) programmatic lifecycle shifts, and (3) the convergence of priorities.



<b>Core concepts</b>	<b>Second order concepts</b>	<b>Related concepts with key references</b>	<b>Empirical data</b>
<b>Fluctuating exploration-exploitation emphasis: simultaneous, but shifting</b>	Changing lifecycle conditions	Vacillation perspective (Boumgarden, Nickerson & Zenger, 2012; Raisch & Tushman, 2016; Kang, Kang & Kim, 2017)	- Engineering (exploitation) and science (exploration) activities simultaneously present activities occurring throughout the ISS program's development
	Contrasting, but inter-reliant capabilities		- Emphasis fluctuated over time between engineering focus and science research at the individual (micro) and program (macro) level
	Converging organizational priorities	Oscillating pendulum (Markides, Oyon and Schnegg, 2017)	- Program lifecycle shift from assembling the ISS vehicle (exploitation) to full utilization of the ISS platform for science (exploration) - Historical capabilities supporting the program and its present operations originate from previous program (STS Shuttle) and emphasised engineering - Shifting ISS program requirements give more to emphasise science (exploration) than previously
<b>Progressive layering of antecedents</b>	Separation model	Structural differentiation (Tushman & O'Reilly, 1996)	- ISS program initially structured with engineering and science as separate capabilities contained within independent offices, structures and processes
	Structural separation punctuated by limited degree of integration	Targeted-integration (O'Reilly & Tushman, 2011)	- ISS restructure designed to integrate certain science focused activities into areas in the engineering offices, bringing a degree of task related integration
	Assimilating contextual integration and structural differentiation	'Balance dimension' & 'combined dimension' synergistic effect (Cao, Gedajlovic & Zhang, 2009)	- Performance measures indicated structural changes were not achieving strategic objective, and science ISS users continue to complain - RISE initiative undertaken to enable deeper strategic change to transform program wide culture and processes

Core concepts	Second order concepts	Related concepts with key references	Empirical phenomena
<b>Context-reshaping capability: dynamic capabilities and micro-foundations (MF)</b>	Sensing, identifying change opportunity MF: non-routine learning MF: informal network relations MF: intramural cognitive frame	Dynamic managerial capabilities (Helfat & Martin, 2015) - human capital, social capital, managerial cognition	- Voluntary, out of the norm training on strategy organized by middle managers - Middle managers utilized network relations to share knowledge - Experiential knowledge of the program, activities on the ground and management's strategic intention enabled middle managers to decipher dissonance and cognitive distance in translating strategy to operations.
	Seizing, execute the change strategy MF: middle managers	Middle managers & strategy formation: boundary spanning & translators (Floyd & Wooldridge, 1999; 2000)	- Middle managers central figures in designing and executing cultural change strategy to assimilate context and structural differentiation to effectively support science and engineering capabilities
	MF: unconventional practices and structures	Informal organization & informal practices (Blau and Scott, 1962; Chan, 2002); Loose coupling (Weick, 1976)	- RISE team intentionally positioned outside the program structurally and geographically - Reported directly to program director skipping layers of upper management
	Reconfigure, long-term renewal MF: semi-autonomy at ground level	Employee empowerment (Ford and Fottler, 1995; Lashley, 1999)	- RISE initiative provided framework empowering ground level staff to decide and implement changes operationally in their areas attuned to the strategy and framework

Table 5: Conceptual framework of data

**i. Contrasting, inter-reliant capabilities and mode of operating (paradox)**

Contrasting, inter-reliant capabilities and mode of operating refers to the paradox of the fluctuating nature of exploration and exploitation. Paradox theory notes the two dimensions are in opposition yet interrelated and persistent over time (Bednarek et al, 2017). In the same way, analysis found that the ISS exploration-exploitation activities and modes of operating were in conflict but simultaneously co-dependent. Furthermore, fluctuations in the unit's emphasis towards either exploration or exploitation occurred as a result of contextual factors. The fluctuating paradoxical nature of the ISS explore-exploit tension was found to be underpinned by two organizational paradoxes - features that are related and codependent in order to function, yet were operationally at odds: (a) strategic vision and operating level, and (b) historical capabilities and shifting current requirements.

**(a) Incongruity between strategic vision and operational translation**

An organization's strategic vision presents the intended goals and actions the organization is to achieve, and within the strategy process is what becomes translated into operations. Hence, the strategic vision and organizational operations are related and go hand-in-hand. However, analysis of the ISS case found that the explore-exploit strategic vision and its operationalization though related were also at conflict in practice, for the dual focus of the strategic vision was in contention with the emergent dominant emphasis that arose in practice.

***Strategic vision (dual explore-exploit emphasis):*** From its outset, the strategic intention of the ISS space station was founded upon the dual strategic pursuit of exploration and exploitation – enabling the exploration of new scientific knowledge by means of exploiting existing engineering and technological capabilities – thus emphasizing both dimensions to the same extent and magnitude. Firstly, in relation to exploitation, the space station program was motivated to further NASA's expertise and capabilities in space exploration; thus re-establishing America's leadership in space, and represented a political response to Russia's launch of the Salyut 1 in 1971 and its development of the Mir space station (Brunner and Byerly Jr, 1990). It served to reinforce two core objectives listed under the U.S. 1958 Space Act in contributing materially to, “(2) the improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles, (3) the development and operation of

vehicles capable of carrying instruments, equipment, supplies, and living organisms through space”. For NASA officials, the new space station was rendered “the next logical step” in the U.S. space program and was to be “built upon the operational capabilities of the Space Shuttle”<sup>8</sup> following the Shuttle being declared no longer experimental but an “operational” routinized space vehicle by 1984. Congress also mandated that the space station would be built upon existing technological and knowledge capabilities developed from the Shuttle program and previous space missions: “[...] in 1988, Congress decreed that the station would have to be built from existing technologies to reduce costs and risks. Many re-designs took place” (Internal document, 2012)<sup>9</sup>. This reinforced the strategic exploitation agenda for efficiency and streamlined activity, as exemplified by a former director of the ISS who suggested that “we [NASA] came out of that [ISS] program design, a more lean, and much stronger program” (Internal document, 2012). In the 10 years prior to the commencement of the ISS space station, the Shuttle program had been the major technological development for NASA and the ISS provided an opportunity to exploit the knowledge and technological capabilities gained during the Shuttle program to build, maintain and operate the ISS effectively. Hence, the pursuit of exploitative activities was intentionally built into the strategy for the ISS:

“One of the cornerstones of NASA's mission -- human space flight -- has crossed the threshold to permanent occupancy of space, using the remarkable capabilities of the Space Shuttle and its crew to assemble the International Space Station” (NASA History)<sup>10</sup>

Secondly, ‘the expansion of human knowledge’ is one of NASA’s core objectives and is listed as number one in the US Space Act<sup>11</sup>. Knowledge expansion through innovation is a key feature of NASA’s space missions and the Agency’s operations, a trait highlighted by a NASA Administrator who expressed “we love to take on ambitious goals, especially those that inspire us to create innovative

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<sup>8</sup> NASA Administrator James M. Beggs (1981-1985): JSC Archives

<sup>9</sup> Quote taken from NASA Researcher News, Langley Research Center, (2012) (internal document)

<sup>10</sup> NASA History Office, Administrator D.S. Goldin’s accomplishments

<sup>11</sup> The NASA Objectives of Aeronautical and Space Activities contained within the National Aeronautics and Space Act of 2010 lists as its first objective “The expansion of human knowledge of the Earth and of phenomena in the atmosphere and space” (124 STAT. 3331)

technologies where existing tools fall short”<sup>12</sup>. Exploration at JSC traditionally orientates around technology and engineering innovation, a feature which has led to multiple NASA-originated technologies, patents and inventions that have been spun-off, and contribute to the development of commercial products and processes: “Many of these advances and enabling technologies, originally developed to meet [NASA] mission needs, have spun off into commercial products that make life on Earth better today” (Senior technologist)<sup>13</sup>. The exploration agenda for the ISS is more nuanced going beyond engineering and technological innovation to focus on expanding scientific knowledge by stewarding experimentation and innovation to further scientific research and space discoveries – a core feature declared at its inception by President Ronald Reagan (1984): “A space station will permit quantum leaps in our research in science, communications, and in metals and lifesaving medicines which could be manufactured only in space”<sup>14</sup>. Hence, exploration and exploitation can be seen to be two core concurrent features of the US strategy for the ISS, where neither dimension has a pronounced emphasis and are interrelated.

***Operating mode and emergence of dominant emphasis:*** Despite the strategy’s dual strategic emphasis on exploration and exploitation, operationally, a dominant mode of thinking and behaving existed across program management and ground level staff emphasizing exploitation; and this pervaded the ISS program’s development and assembly. The ISS program operated under an engineering logic dominated by the principles of executing technical excellence, control restrictions, stability and safety with little margin for error or risk-taking. ISS program insiders described it as “taking a conservative approach and making safety paramount”<sup>15</sup>. The engineering logic maintained a drive and emphasis towards executing technical capabilities and became the focus of senior managers within the ISS program, as represented in the ISS Taskforce comments: “The management focus is on technical excellence and crew safety with emphasis on near-term schedules” which the Taskforce claims materialized in the program’s critical cost management systems: “the focus of the ISS program

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<sup>12</sup> NASA Administrator (Bolden Jr) NASA Spinoff (2013), p. 5

<sup>13</sup> NASA Spinoff magazine (2013), p. 7

<sup>14</sup> Ronald W. Reagan. State of the Union Address. January 25, 1984.

<sup>15</sup> ISS Task Force, 2001 (internal)

office has been tactical, near-term and budget oriented as opposed to strategic, long-term and cost-based”<sup>16</sup>.

The program’s dominating operating logic also has a strong focus on safety. This safety culture formed a core feature of the processes, systems and culture within the ISS program which reverberated throughout the wider JSC organization. As part of safety, the program’s systems and processes focused on maintaining stability and control in all operations due to the high-risk nature of manned space endeavors: “Of course, the microgravity environment in space is not conducive to human life, so you have to protect human life. I think we’ve learned those systems and those technologies. We know how to operate” (Division Director, phase 3/2015). This attention to safety reflects the effect the Shuttle disasters (Challenger in 1985 and Columbia in 2003) had on the operating behavior and thinking of actors within the ISS program. For example, one Division Chief (phase 2/2014) explained that:

“Now, when you think about it, we had two major accidents with the shuttle. And that'll get your attention. And so, every time there was a Shuttle launch, we were focused. And before, you're making sure everything is done right. Every problem is just pounded flat until you understand every single problem down to the nth degree. That's the environment that shuttle was. And it made you do your job and do it well. And if you didn't, well you're out. We'll get somebody in here who can do it. So that's the sort of focused intensity that the shuttle brought”.

As a consequence of the dominant logic and its focus on engineering and safety, the exploration agenda took a secondary position operationally during the ISS’s development and assembly. Although some scientific research activities were conducted during the space station’s development, there was less emphasis, focus and operating effort targeted towards exploration and science discovery. Instead, the program’s managerial and functioning focus centered on exploitation capabilities - engineering and the technical construction of the ISS.

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<sup>16</sup> Ibid

**(b) Historical capabilities and shifting existing requirements**

Analysis found that an organizational unit is conditioned by the resources and capabilities it inherits from previous strategic programs/agendas. In utilizing resources and capabilities historically established the unit not only gains technical and tacit knowledge, but the behaviors, processes and systems formerly developed (Marquis and Tilcsik, 2013). Consequently, these can emphasize and be skewed towards either an explorative or exploitative disposition depending on the strategic purpose for which they were developed. However, when confronted with a contemporary requirement for ambidexterity, where exploration and exploitation are necessitated, the study finds tension occurs between the historical legacy and the changing organizational requirements needed to fulfil the new strategy, thus resulting in a fluctuating tension between historically framed capabilities and present explore-exploit conditions.

***Historically inherited capabilities:*** The ISS program’s dominant mode of thinking and operating can be traced back to inheriting the legacy of its preceding program, the Space Transportation System (STS) program (also known as the Space Shuttle program). Existing capabilities and resources from the STS (Space Shuttle) program and the Shuttle’s development were transferred to and utilized by the ISS program, as illustrated by the excerpt below:

“Human Space Flight programs have historically been focused on protecting crew safety [...]. A large percentage of employees working on the ISS program have gained their skills and experiences on the Shuttle and earlier manned programs. There are many indications this experience base and culture have been transferred to the ISS program” (ISS Task Force, 2001)

The Shuttle program was primarily an engineering endeavor, considered “a tremendous engineering achievement – a vehicle that enabled nearly routine and regular access to space for hundreds of people [...]” (Hale, 2011). When it came to the ISS Program, STS afforded an operational and organizational blueprint upon which the ISS program’s managerial approach, engineering mindset, systems, processes and culture were modelled. The chief scientist (phase 4/2015) illustrated this point saying:

“there were a set of engineering requirements documents that told you all the things you had to be sure you had done before you would be safe to fly on a human space flight vehicle. And those things, some of them had been developed 20 years ago for the space shuttle. And then, the heritage of those documents had been passed down [to ISS]. ‘It doesn't have sharp edges so an astronaut won't get cut, it doesn't have any materials on the dangerous list’, and all that kind of stuff [...] And so it used to be that people treated [ISS] space missions as if you have a shuttle flight”

***Shifting requirements (explore-exploit emphasis):*** In 2005, during the construction of the ISS platform, U.S Congress passed the NASA Authorization Act declaring the U.S segment of the ISS a national laboratory. This enabled other Federal agencies, non-profit organizations and the private sector access to the space station for scientific and technological research discovery; “signaling a renewed dedication to full utilization of this structure for science projects [...] and full-time scientific experimentation” (NASA, 2010)<sup>17</sup>. The Authorization Act marked a political emphasis, which directed the NASA strategy, towards scientific research which had not been reflected operationally in the ISS program under its historically inherited dominant engineering logic;

“There are a lot of people in the scientific community that lost faith in NASA. They were already frustrated because it had taken so long for them to fly [experiments on board the ISS], because they came in with scientists’ unrealistic expectations of us following a schedule, which has never happened in the history of human spaceflight [...]. It was, I would say, a pretty big low point in the history of ISS from a research perspective. All of that was happening right at the end of fiscal year 2004, I believe.” (a Division chief, 2015)<sup>18</sup>

The 2005 Authorization Act also expanded science innovation opportunities by granting non-government researchers access to utilize the platform in ways previously unavailable: “Until recently U.S. research space on board the ISS has been

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<sup>17</sup> NASA Spinoff benefits from ISS (2010) (magazine)

<sup>18</sup> JSC Oral History Transcript, (2015)



reserved mostly for government initiatives. But new opportunities for commercial and academic use of ISS are now available, and 50 percent is set aside for them” (JSC history coordinator, 2015)<sup>19</sup>.

With completion of the space station in May 2011 the platform officially became a National Laboratory. ISS program management sought to shift the program’s focus towards a new logic that emphasized science missions and experiments in greater measure. Although management’s focus shifted towards emphasizing exploration, and the program’s functional units were attentive to this, operationally the program struggled to adjust to the swing towards science research and innovation and was found on occasion to switch back to the dominant engineering (exploitation) logic in periods of uncertainty. Operationally, the program’s focus and strategic emphasis fluctuated back and forth between research experimentation and engineering stability for the two domains were perceived to be semi-compatible. The pursuit of scientific research and innovation occurred under the proviso that safety and stability were not compromised, and in the event where this appeared to be challenged, the historically rooted dominant engineering logic would supersede signifying a friction:

“People had this perception, if things were going safely and the supplies were good, then everything else was kind of gravy. And, so then the moment anything went wrong, they would just cancel the research - because that's what they were used to the priority being during assembly” (Chief scientist, phase 4/2015).

One division chief expressed the challenge the program faced in adjusting to the swing in emphasis between scientific research and the dominant engineering and safety logic: “we really had to do some work to change [...] because people who had worked for a really long time having safe operations be enough were now being challenged that no, safe operations isn't enough. You have to do safe operations and you have to get a research program done”.

For the ISS program, the shift towards science research challenged the prevailing operating logic and brought to light the contention between their prevailing

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<sup>19</sup> JSC Oral History, August (2015)

capabilities and traditional way of work alongside the new emphasis requiring a focus on research exploration.

**ii. Programmatic lifecycle conditions and fluctuations between exploration-exploitation**

The analysis indicated that the fluctuating emphasis between exploration and exploitation was conditioned by the programmatic lifecycle which defined NASA's space missions. It was also the lens through which actors viewed the program's activities and determined strategic focus and priorities. This feature draws parallels with Raisch and Birkinshaw (2016) theoretical perspective that organization's adopt a dynamic approach and switch between exploration and exploitation as a natural part of the life-cycle stage transitions they experience. However, whereas Raisch and Birkinshaw (2016) refer to the dynamic and temporal shift between explore and exploit, where they are pursued alternatively, the findings herein find that explore and exploit remain simultaneously present but the emphasis and prominence is what fluctuates.

The ISS program lifecycle evolves through a number of distinct work stages which a JSC CEMSA report suggests can be summarized for simplicity into "five major phases: definition, design, development, use and evaluation", and each phase contains multiple work stages/milestones (JSC Archives, 1975)<sup>20</sup>. Within the space program, actors purported that the dominant engineering logic catered operationally to the development and assembly phases of the space station:

"In the early years we were very, very fortunate in that everybody was really focused on building these vehicles, building these platforms, getting them assembled on orbit, and flying safely, just like we were. Other than the challenges we had along the way... Everybody's focus was the same. 'We have to go build this thing. We need to focus hard on that and get it done.' [...] it was always about building the Station, and that was the focus" (Director, 2015)<sup>21</sup>

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<sup>20</sup> JSC Archives - CEMSA Report "The Management of organizational change: Analysis of the Johnson Space Center (JSC) Management of the Lunar Science Program. Refer to JSC Archives for an expansion on the multiple steps and work stages constituting a NASA/JSC manned space program.

<sup>21</sup> JSC Oral History

The engineering logic with its technical execution was considered a necessity for the program's initiation and successful development of the space station; and therefore justified the mindset and culture governing the program's activities and focus, as explained by the Chief Scientist:

“the program was very driven by the fact that they're going to bleed money left and right if they don't get assembly done, so you've got to get assembly done and it just doesn't matter. If you don't get assembly done, everything will fail, so getting a little research on the side is not important in that assembly phase”, and also expressed that “the engineering org that was ISS just wanted to focus on assembly and keep going”(phase 4/2015).

Transitioning from assembly to full utilization denoted a change in the program's lifecycle. The change from one critical phase to another necessitated an adjustment in the program's focus. Utilization required a different logic and culture: “trying to start adding a culture of caring about science in this operational organization that was totally focused on assembly” (Chief Scientist). Despite the lifecycle transition to the utilization phase, the dominant logic persisted operationally across the program, governing the behavior and thinking of actors even though senior management's focus and strategic intent had shifted towards science research; “safety was paramount and would stop experiments and mission success was still measured by safety and not by enabling scientific discovery” (a Division Chief).

Interestingly, an interviewee noted the length of time in which the program had been in the assembly phase to be a significant factor, for it conditioned patterns of thinking, behaviors and the way processes were configured. The data suggests that the program had become organizationally entrenched within a particular lifecycle stage that suited the historical legacy of its capabilities and dominant operating logic, and therefore made it harder for the program to enter into the next lifecycle stage and shift its strategic emphasis:

“In a way, I think if we'd been able to build ISS in a year, we wouldn't have set up those patterns [processes and cultural behaviors] that deeply, but because it took a decade to build it, it's taking a lot longer to disentangle that. It's because it's been so ingrained” (a Division Chief).

**iii. Convergence of priorities:**

Analyses found that the relationship between exploration – exploitation did not remain static or in perpetual a state of conflict but altered over time, shifting from a state of conflict to one of convergence where the accomplishment of exploration and exploitation shared common priorities and purpose. This finding can be seen to be reflective of the paradox view of tensions where the dimensions of a tension are distinct yet interrelated in nature (Lewis and Smith, 2014; Smith and Lewis, 2011), and therefore suggests that the relationship between the dimensions is fluid in nature.

For the ISS the emphasis on exploration and exploitation is simultaneous and of relative equivalence, suggesting the convergence of priorities acts as another factor contributing to the fluctuating nature of the exploration-exploitation tension. With the transition to full utilization in 2011, exploration and exploitation were no longer independent activities but operationally interdependent, with combined priorities and strategic agendas:

“The hard part is when you’re doing something that’s different from the norm, what people were brought up to do. There are a lot of areas where this was a big deal, but one of the biggest for the ISS Program is when we started to transition from, ‘Okay, we’ve finished assembling this thing’ to, ‘Okay, now we have to utilize it.’ It was a different set of priorities”  
(Program director, 2015)<sup>22</sup>.

Completion of the ISS’s assembly in 2011 marked a tempered emphasis in program stability and control (exploitation), and an expanded focus on flexibility and adaptation (exploration). Full utilization of the ISS represented a convergence of strategic priorities, where mission success for the exploitative engineering offices and the scientific exploration unit amounted to being one in the same. Mission success became an interdependent activity between these two areas, thus redefining the meaning of mission success:

“So, there are a lot of implications there, especially from the operations directorate. Their whole motto from Apollo all the way through [to now], is failure is not an option. And we’re telling them, yes, it is. Your definition of success changes. Success is enabling scientists to make discoveries. Success is enabling scientists to perform their experiments. Keep the

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<sup>22</sup> JSC Oral History Transcript (2015)

laboratory up and running. It's not saying that it all goes perfectly, okay. So, this is a difficult, a really difficult concept for a lot of people to understand. We always stress every time we talk about it, 'safety of vehicle, safety of crew' is non-negotiable. Those have to be in there..." (Change agent, phase 4/2015)

Mission success constitutes a core aspect in the JSC community and ISS program. The motto 'failure is not an option' underpins the culture of the organization. Operationally, during the initial stages of the ISS utilization phase, the dominant engineering logic persisted and defined what mission success looked like. For actors across all levels of the ISS program this meant accounting for risks in advance and devising mitigating solutions. The ISS Change Lead explained that traditional program requirements demanded science researchers wishing to launch an experiment onboard the ISS had to show that their intended experiment would result in 100 percent mission success prior to actually completing the tests, thus leaving very little room for novel insights from experimentation and new knowledge discovery:

"We were levying what we call [engineering] mission success requirements on the scientist. Everything they did, how their hardware worked, how everything went together had to be perfect and they had to prove to NASA that their experiment was going to work"  
(Change agent, phase 4/2015)

The post-assembly phase created new internal organizational parameters within which exploration and exploitation activities were engaged, and redefined the program's operating model. In this new context, the ISS program struggled to operate explorative and exploitative functions effectively and therefore embarked on a new change initiative known as RISE (Revolutionize ISS for Science and Exploration) intended to engender the ISS program to operate explore-exploit activities ambidextrously and effectively.

## **2. Evolving hybrid approach: Progressive layering of antecedents**

The fundamental challenge facing the ISS program, from the perspective of program actors, was balancing the execution of engineering and safety requirements whilst also enabling scientific exploration effectively. In analyzing the development of

the ISS program and how exploration and exploitation came to be managed simultaneously and effectively, the data indicates the ISS program did not engage in only one ambidextrous approach or configuration, but various antecedents. The study found that the program engaged with a combination of structural and contextual approaches, similar to those presented in ambidexterity literature, progressively and to varying degrees. However, the study identified distinguishing features in the ISS program's approach to effective ambidexterity differentiating it from the antecedents presented in ambidexterity literature. What made the pathway employed by the ISS program distinctive was that structural and contextual approaches' were layered progressively over time forming an evolving hybrid configuration. As such, the data suggests complementarity between the different antecedent pathways enabling ambidexterity (Agostini et al, 2016; Kauppila, 2010). The study found that the approach to ambidexterity within the ISS program evolved over time in adjustment to internal and environmental dynamics, producing the hybrid approach. The following details how the program's approach to ambidexterity evolved, why it evolved and the mechanisms that enabled it to occur.

*i. Traditional ISS program model: principle of structural separation*

During the planning and construction of the ISS (1993-2011), the program's intra-organizational design was governed by the principle of structural separation (Tushman and O'Reilly, 1996; Jansen et al, 2009) between office divisions. Exploitation units – the engineering division, operations and support – were each distinct with different systems, processes and cultures that were also separate from the science research unit: “As an example, a substantial sustaining engineering function has been established separate from the operations structure” (ISS Task Force, 2001). Influenced by its dominant engineering logic, the distinction between research interests and engineering operations was an intentional one, originating from the program's initiation, and was deemed ideal and appropriate for the complex ISS construction, as exemplified by one division chief: “So ISS as a program was originally structured as an engineering organization to build and operate ISS successfully”. The ISS Taskforce report goes further noting that the “Science program is not integrated in the ISS management” (2001), thus indicating the separation between the explorative and exploitative program units in structure and management.

The ISS program is characterized by formal structured relations, defined processes, roles and responsibilities and a degree of bureaucracy, reflective of Burns and Stalker's (1961) concept of mechanistic management systems. With building and operating the ISS platform safely being the program's main concern, its organizational design, processes and systems were driven primarily by engineering, hardware and systems development. This was reflected in the formal structure of the program. Organized by way of alphabetical significance, ISS program office divisions are coded and hierarchically ranked based on engineering and programmatic importance. The more important the office, the higher up in the alphabetical hierarchy it resides:

“So originally, well there was a hierarchy of all of the offices when the ISS program was setup. You can see it in the organizational codes, it's still there today. So, OB is the vehicle office. OC is mission integration. OD is software and avionics. You can see, it like follows the engineer's mindset about how important different systems are [...] and the ancestor of the [science] research integration office we have today was called the payloads office and it's OZ. So, that tells you exactly kind of how the engineers were thinking about that” (Change agent, phase 4/2015)

For the ISS Program, engineering activities and operational support represented routine tasks and scientific research was an exploratory mode of working that was distinct to the routine tasks of building a space vehicle and was seen as auxiliary: “provided the safety of the crew and vehicle was maintained and tasks, such as attaching the ISS modules together and risky extravehicular activity (EVA), were successfully completed, all other activities were in excess of what was required” (chief scientist). Consequently, by maintaining separation between research (explore) and operational (exploit) units the program had to contend with incoordination, despite the ISS senior management team having oversight and direction over both areas. In 2001, prior to the completion of the space station's assembly, the ISS Taskforce noted that the lack of integration between the science unit and program operations created a detachment which manifested in issues with budget and management of the science unit:

“A disconnect exists between research and the ISS program office. The research approach appears insular. It appears to lack coordination [...]. It is not

part of an integrated financial management strategy and, ultimately, may be frustrating the development of a robust science program”

*ii. Structural augmentation: targeted-integration of exploration and exploitation*

The progression or second layer of the program’s approach to ambidexterity built upon its established model of structural separation. This second configuration was conditioned and dependent upon a shifting emphasis in the program’s exploration-exploitation tension. The shift in emphasis was a result of explore-exploit priorities morphing from a state of independence to convergence and interdependence. With the completion of the space station’s construction in 2011 the program transitioned to full-utilization which represented a major shift and saw priorities for science research and operational activities converge.

“That transition was a big transition for the team. You went from this NASA process—where just successfully getting a crew into orbit and back home safely was everything—to okay, so we have to keep the crew safe, surely, but we have a job to do. You talk about the means to an end—the end wasn’t the assembly of ISS. Really, the end was utilization of ISS.” (ISS Program Director)<sup>23</sup>

In early 2012 the ISS program director proceeded to “fine tune its [the program’s] organizational structure to better focus on achieving the full scientific capabilities of the ISS” (Program Director)<sup>24</sup> and announced that the program would be restructured from the top-down so that some of the exploration duties were redistributed across the operational office divisions. For example, the avionics office was given responsibility for all payload software related to science research activity as well as their routine charge of maintaining the ISS vehicle software: “The Avionics and Software Office (OD) now maintains all avionics and software related services needed for the execution of utilization on-board which allows for greater efficiency in planning and executing avionics and software maintenance with a priority on utilization”<sup>25</sup>. The intention of this being that senior management had identified complementarities between capabilities and processes in the engineering and science

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<sup>23</sup> JSC Oral History Interview Transcript (2016)

<sup>24</sup> ISS Program Director internal presentation (2012)

<sup>25</sup> Adapted from Program Director internal presentation (2002)



units/offices, and sought to integrate the science element into the relevant engineering unit; thereby redistributing some of the science research responsibilities across the various operational program office. With utilization and science research integrated into operational (exploit) office divisions, management believed they could generate change and prioritize scientific research so there was a consistent emphasis across office divisions.

“The ISS program director wanted to change the organizational structure and move relationships quite violently at his work level, to focus on [research] payloads. Insularly only payloads were talking but not the wider organization. [The program director’s] intention was to get everyone talking about [research] payloads and not just the payloads group. In the reorganization, it pushed [research] payloads into all the groups so the same org did systems, logistics, robotics etc., all had it for payloads to get everyone to think about payloads” (Change agent, phase 4/2015)

Data analysis suggests the reorganization represented a punctuation of the program’s differentiated structural design. The separated operational units, each of which held formal processes and procedures, were partially integrated with elements of science research, bearing similarities to O’Reilly and Tushman’s (2008) concept of targeted integration. (See figure 1 for a graphical illustration of the ISS program’s reformed structure with targeted integration). The operational and science units were found to no longer be completely separate as per the structural approach in ambidexterity literature. Rather, the program structure maintained some degree of separation between the operational and research units as the different areas maintained a primary responsibility and focus to its office division’s objective. However, science was partially integrated into the objectives and function of the operational units. This approach departed from its traditional structural model which maintained separation between these activities: “The ISS restructure happened quickly and each of the program offices adopted their new research related responsibilities” (Division Chief), though “the [science] research payloads office (OZ) remained the principle steward of [science] utilization, serving science research users of the ISS” (Program Director).

In initiating the structural reorganization, management utilized structural mechanisms in an effort to prompt change in the program’s dominant thinking so that

everyone, irrespective of discipline or office division, paid greater attention to science exploration activities and research customers. However, the reorganization did not produce the intended effect and negative customer satisfaction feedback from science researchers proved that the program was not operating its exploration and exploitation activities effectively.

“We were losing [research] customers and payload developers were complaining about the process to interface with us to get to the ISS. The process was not customer friendly, and was not geared towards helping the science customers get to space station”  
(Change agent, phase 4/2015)

ISS program senior management’s intention for the reorganization had been to shift the program’s emphasis towards scientific research, the study found the dominant engineering logic persisted, impeding the reorganization’s purpose and contributed to the negative science customer feedback. Consequently, the partial integration of science and engineering operations in formal processes and procedures alone was insufficient in generating effective explore-exploit ambidextrous performance. In reflecting upon the shortcomings, interviewees noted that the partial structural integration of operational and research activities had occurred at the program level (upper management), a feature reflective of structural ambidexterity’s promotion for integration at the senior level within literature (Jensen et al, 2009), and had not translated to the lower levels of the program and the operational tasks of frontline employees:

“The intent was right, but the reorganization happened at a program level and didn’t go down into the organizations [program offices] to actually talk about how people do their jobs. What happened was that everybody brought into the reorganization, took in the new responsibilities and used their existing processes, their existing procedures, and their existing culture to bring it in and do it” (Change lead)

Interviewees observed that the lack of integration between science and ISS operational units was prompted by the operational units absorbing and performing the new science responsibilities into their existing processes and cultures. It suggests that the operational units did not adjust to accommodate the science priority, but rather

science activities were molded to fit into the existing systems of each of the operational units, thus tempering the emphasis towards science research. In trying to operate science exploration processes within the confines and under the logic of engineering held by exploitative office divisions, created a misalignment between processes and function and its explorative purpose. Consequently, this misalignment manifested in the attitudes and behavior of frontline employees who were unable to fully comprehend the purpose of the reorganization and its implications on their activities:

“Reception to this approach was crazy. People did not get it and all they ended up doing was absorbing [research] payloads into the process of what they were doing and took on the responsibility...” (Chief scientist, phase 4/2015)

***iii. Hybrid mode: fusing contextual integration and structural differentiation***

From analyses, a third progression in the program’s pursuit of ambidexterity was identified and had evolved from and was layered upon the aforementioned structural augmentation - targeted integration. Within this third development, the ISS program sought not to dismantle its structural redesign and its distinct yet partially integrated units. Rather, it set about uniting the new structural form with a recrafted program wide contextual environment geared towards the ambidextrous management and support of science research exploration and operational routines. As the following highlights, this approach is akin to developing contextual ambidexterity at the organizational and individual level (Gibson and Birkinshaw, 2004) within the boundaries of a punctured program-wide structure characterized by an element of separation.

In August 2014 the ISS program launched a new change initiative known as RISE – Revolutionize the ISS for Science Exploration. RISE was designed to transform the mindset and everyday behaviors of the ISS program functionally and its personnel by embedding an emphasis towards science (exploration) across the ISS program whilst simultaneously maintaining safe stable operations (exploitation) of the ISS platform effectively. The RISE change team reasoned that a renewed organizational structure, even with targeted points of integration, was on its own incapable of producing the change needed to transform the program to be effective in

managing science innovation and engineering execution. The RISE change team identified that change had to occur on two fronts – on the individual level and wider program level through cultural and contextual means.

“Many, many people around here are so committed to human space flight, and are really not committed to science. They know it's like a necessary thing, if you don't do some science, nobody will fund your space flight project. But they're really all about putting astronauts in space. So, what RISE is about is trying to make that level of cultural change, where people see the importance of the researching in its own right and it even has elements of communication, making sure our own employees understand why the research is important” (Chief Scientist)

The study found that this third progression in the program’s pursuit for effective ambidexterity emerged from building a context-reshaping capability through the RISE initiative. Doing so enabled the integration of structurally differentiated and contextually integrated antecedents within a restructured unit design.

Figure 1 below illustrates the layered development of the ISS program’s evolving hybrid approach from its traditional model of structural separation to targeted integration and then contextual integration.

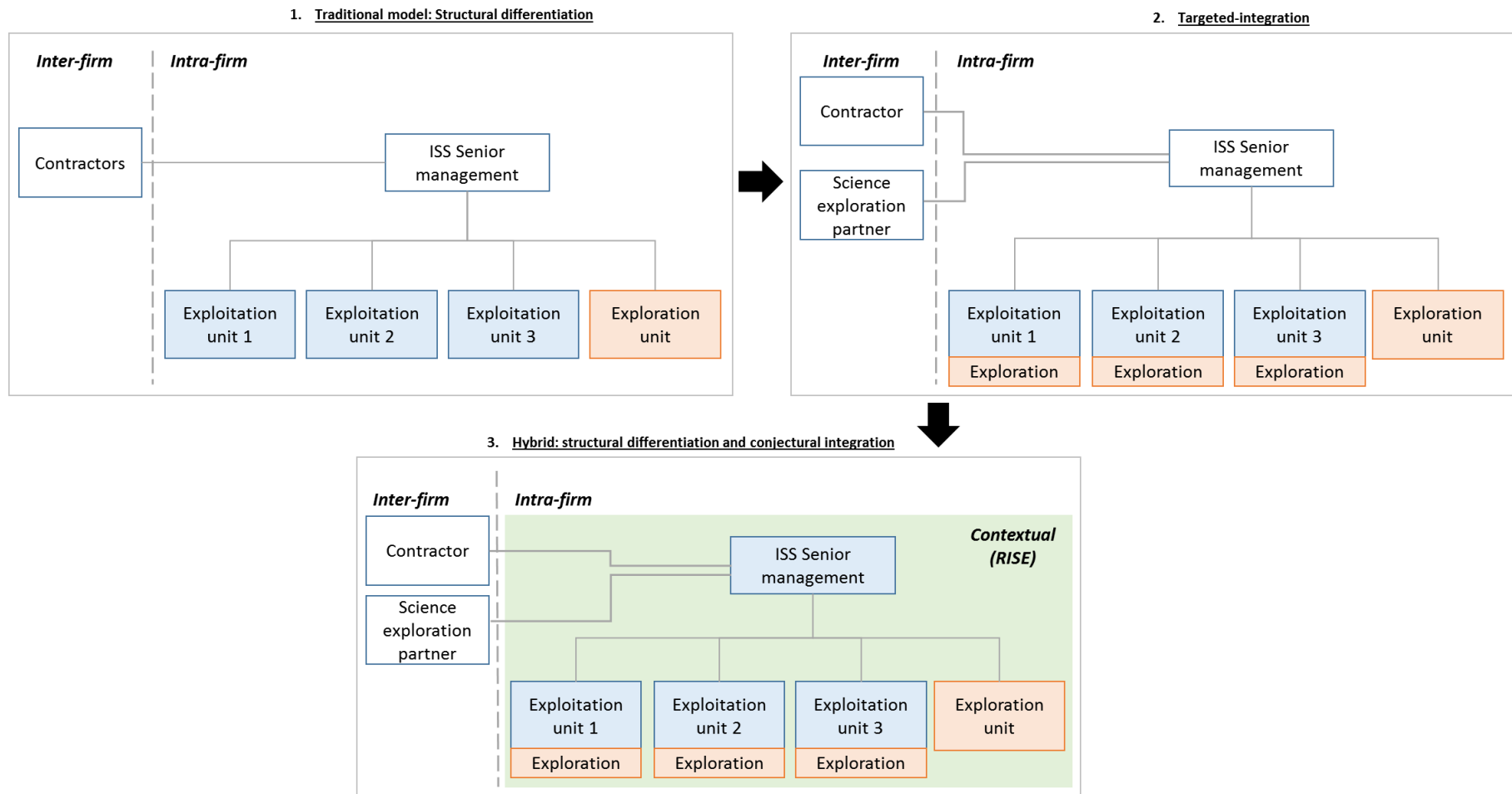


Figure 1: Illustration of the ISS program's evolution from structural differentiation to hybrid of structural differentiation and contextual integration and hybrid (Illustration is author's own depiction)

### **3. Context-reshaping capability: Dynamic capabilities and its microfoundations enacted through middle managers**

Analysis of the program's third progression or evolution is of particular interest as it relates specifically to the intersection of structural and behavioral antecedents to ambidexterity. It also provides insights into how the context-reshaping capability was developed and its effect on promoting ambidextrous performance. Analysis of the mechanisms and micro-mechanisms underpinning the context-reshaping capability revealed particular skills, processes and decision rules enacted by the RISE team amidst its changing environment, which resembled dynamic capabilities and its microfoundations (Teece, 2007). To expound upon the development and subsequent effect of the context-reshaping capability that enabled effective ambidextrous performance of science exploration and engineering exploitation within the ISS program, the analysis draws on Teece (2007; 2014) analytical categorization of dynamic capability processes – (1) *sensing* and identifying opportunities and threats, (2) *seizing* and mobilizing resources to address opportunities (3) *reconfiguring*, combining and enhancing intangible and tangible assets for continued renewal. The study found that in the case of the ISS program and the RISE initiative, each of the three dynamic capability processes were underpinned by distinct skills, micro-mechanisms and structures which were foundational to enabling the manifestation of the context reshaping dynamic capability. The sensing process initiated the context-reshaping and was found to be undergirded by dynamic managerial capabilities (Adner and Helfat, 2003; Helfat and Martin, 2015; Kor and Mesko, 2013). The seizing process, which saw the design and mobilization of resources for context-reshaping, was found to be underpinned by unconventional structures and processes that depart from the organization's norm, reminiscent of the concept positive/constructive deviance (Mertens, Recker, Kohlborn and Kummer, 2016; Vadera, Pratt and Mishra, 2013). And to maintain the context-reshaping capability that enabled the program to perform ambidextrously effectively, the reconfiguring process was supported by semi-autonomy at ground level.

The dynamic capabilities perspective maintains that the orchestration and configuration of an organization's tangible and intangible resource base are the result of senior management skills (Teece, 2014). However, analyses that found middle managers were foundational to the development and direction of the ISS program's context-reshaping capability and were the ones who actively planned, mobilized,

transformed and redeveloped the program resource base, as opposed to senior management. Hence, middle managers demonstrated the capacity to design and configure an approach to achieving organizational ambidexterity that integrated and layered structural and contextual antecedents, a hybrid, whilst senior management assumed a supporting auxiliary role.

**(a) Sensing: initiating context-reshaping through dynamic managerial capabilities**

Teece (2007) explains that “sensing new opportunities is very much a scanning, creation, learning, and interpretive activity” (p. 1322), features that Birkinshaw, Zimmermann and Raisch (2016) equate to exploration. With regards to the ISS program and RISE, initiation of the context-reshaping capability was underpinned by features echoing dynamic managerial capabilities – managerial human capital, managerial social capital and managerial cognition (Helfat and Martin, 2015). Through a combination of experiential knowledge of the program, new knowledge learning activities, and network relationships, ISS middle managers identified that the cognitive frame underpinning the program’s ‘dominant logic’ (Kor and Mesko, 2013) inhibited it from translating and operating exploration and exploitation activities effectively and simultaneously.

**Microfoundations to sensing: dynamic managerial capabilities**

i. ***Human capital: non-routine learning***

Human capital relates to managers acquiring skills and knowledge learnt through education and experiences (Helfat and Martin, 2015). In the case of the ISS, the sensing process and the subsequent discovery that the program’s dominant logic was an inhibitor emerged from a non-routine learning activity in 2014, during which middle managers developed the strategic skills to scan and interpret the organization’s external environment and understand the changes being experienced by the program. Sponsors of the training class believed that if middle managers could be trained to do strategy it would help to open up strategic discussions between upper and lower levels of the program.

“Completely separate from anything we do in our daily work, some of the managers and deputy managers in space station wanted to do strategic planning for individuals for training, so we put together this class.

It was a day and a half class and in that class a facilitator took us through an activity of deconstructing our vision and mission [...] it was only a day and a half class but it felt like three weeks. It was very intense” (Change Lead)

The process of deconstructing the program’s vision and mission for science (exploration) and sustained development of the ISS vehicle (exploitation), provided a cognitive framework against which the group of middle managers compared the program’s current performance and operations based on their experiential local knowledge of activities and the broader program. What emerged from this cognitive deconstruction-comparison exercise was an identification of program issues which the group interpreted went deeper than the program’s structural reorganization.

ii. ***Social capital: network relations of middle managers***

Managerial social capital involves the ability to access resources and knowledge through relationships (Helfat and Martin, 2015). With the ISS program, non-routine learning occurred as a result of network relations among middle managers. In 2014, approximately two years after the program’s initial structural reorganization, two deputy middle managers from different program offices organized a voluntary non-routine training event. The topic of the training event was strategic planning and it was targeted specifically towards fellow middle managers. The event was sponsored and attended exclusively by middle managers. These middle managers shared relational experiences by virtue of their position in the hierarchy. Having worked closely with front-line staff in a supervisory role and upper management, the ISS middle managers utilized the knowledge they had built through these relationships. In sharing their knowledge and experiences with other middle managers at the training event they developed new knowledge of strategic issues. It was through this relational interaction with other middle managers that the group identified the issues inhibiting effective change in the program:

“...what we had highlighted as a group, there were about 30 of us [middle managers] in that class, that what was stated in our vision and our mission was not how we behaved. We were still behaving in a manner



that's appropriate for an assembling vehicle program, right" (Change Lead)

iii. ***Managerial cognition: identification of organization's dissonance and organizational cognitive distance***

Managerial cognition relates to the mental models and beliefs - 'knowledge structures', employed by managers in understanding circumstances and choice options (Helfat and Martin, 2015). In the case of the ISS program, the data suggests that these middle managers exercised problem solving and reasoning skills, rooted in experiential knowledge, to perceive and sense a misalignment between the program's existing mode of operating and new strategic intent. Using their learning and existing knowledge of the ISS program, the middle managers formed inferential insights and deduced the mismatch between the program's ambidextrous strategy and its current processes and operating behavior:

"so, we [a few of the middle managers] brought a story forward to program management and said we need to reengineer, from the top down [...] We, from our vision and mission, our processes all the way down at the lowest level, people aren't getting it... And, he [ISS program director] agreed" (Lead change agent).

The data suggests that the middle managers identified the existence of *bi-directional cognitive discrepancy* at an organizational level was a factor underpinning the misalignment (scholars note that the term cognitive discrepancy and dissonance can be used interchangeably, e.g. Hinojosa et al, 2017). Drawing on cognitive dissonance theory, the term cognitive discrepancy in the context of this study refers to "a discrepancy between two or more cognitions" (Hinojosa, Gardner, Walker, Coglisier and Gullifor, 2017: 174). And in applying this concept, cognitive discrepancy is expanded beyond the individual level and relates to hierarchical strata's within an organization. I intentionally define this form of dissonance as bi-directional because the misalignment and distortions between strategic vision and operational reality occurred in two directions simultaneously – originating from upper management towards ground-level staff, and dissonance originating from the ground-level towards top management.

The data indicates that bi-directional dissonance was a consequence of *organizational cognitive distance* – a lack of sufficient alignment in categories of thought, perceptions and shared knowledge, to understand other organizational actors, involved in achieving a common goal or strategy (Noooteboom, 2000; Wuyts et al, 2004). Firstly, the program’s upper management were highly strategic in their conduct and discussions on strategic planning and development tended to remain within the upper echelons, and did not filter through to the lower levels of the program. By virtue of their position, upper management were close to and understood the ambidextrous strategic vision and the need for the program to change, but they were considered to be distant and too far removed to see ground level activities. Hence, upper management were disconnected from the program’s lower ranks and were unable to translate the strategy to ground-level staff or communicate how the strategy materialized in daily tasks.

“Program management already saw [the program’s strategic vision]. They already understood the vision. They were already making decisions towards the new vision. What they couldn’t see, was all the levels down lowest in the organization was these people [down here] they didn’t get it ... [there was a] disconnect”  
(Change agent)

Meanwhile, individuals in low-level program roles, had not understood what program management intended to achieve through its restructure, nor the direction management was leading the program, or why further change was needed. Furthermore, the program’s structure did not enable those in lower-level roles to see or comprehend the strategy.

“...the bottom [ground level employees] do not understand the direction we’re headed, right... These guys [lower level staff] don’t see it and we’re not structured properly to get them to see it” (Change agent)

Based on the data, one can inductively infer that because of human capital and social capital, the middle managers involved constructed a model of the organization’s existing reality and comparatively assessed it with the reality they perceived was required to make the strategy a reality. Hence, suggesting a bridging activity between dual cognitive models within the managerial cognition of middle managers.

**(b) Seizing and mobilizing resources: context-reshaping**

The study found that the sizing and mobilizing process of dynamic capabilities was the result of two main factors: (1) the deliberate reshaping of both hard and soft organizational elements; (2) the ability to execute and mobilize resources was underpinned by micro-foundations - unconventional structures and practices.

**i. Reshaping soft organizational elements:**

The study found two soft elements in particular were pertinent to changing the ISS program: (1) redefining its value system, and (2) reprogramming its vernacular.

***Redefining the organizational value system***

An organization's value system is one of the fundamental levels at which an organization's culture is revealed (Schein, 1990). The data shows the RISE team determined that in order to change the program's organizational context it needed to re-evaluate its value system on a broader level because the emphasis on science and supporting science research from external/commercial entities required a different outlook and belief system. This was highlighted by a change team member who expressed: "the value based system was fit for assembling the vehicle which needed it because it was precise, perfect and routine; but the value system does not fit in the context of where we are going with science research and commercial users of the ISS, which needs a different value system if we are to support science research users, so we need to do things differently".

To address this issue the RISE team set about deconstructing the vision and mission of the ISS, and re-evaluating its purpose, core values and the meaning of the values to ascertain the behaviors and capabilities required to enable scientific utilization alongside operational sustainability.

"How do you get people to behave differently, so you get people to see it in the new world? Not saying that they were behaving badly but that they need to behave differently. It's about getting them to understand the 'why' [...] we started with the 'WHY' questions. Why does ISS exist? Why were we doing everything we were doing? Why was it important we made these changes? Only when an organization knows its 'why'

can it define its ‘how’ and ‘what’. We were remaking ISS's why” (Lead change agent).

Furthermore, informants explained that program management gave the RISE change team the latitude to put in place whatever they deemed necessary to change the program’s culture, including redefining ‘mission success’, a value concept that had been a big part of the culture of NASA and the ISS program, provided the change did not harm the safety of the vehicle or crew. Critically, RISE changed the program’s definition of mission success ownership. For the program, achieving mission success would no longer be defined as ensuring that experiments taking place on board the ISS produced successful results nor would the experiments end results be the responsibility of program operations and crew. Instead, responsibility was given to the experiment owners and mission success for the ISS Program was redefined as engendering scientists to perform experiments regardless of whether they worked or not: “we did 2 things from the requirements world is we essentially took the strict mission success requirements off from them [the research scientists] and [...] whether or not their experiment works is up to them. So [...] the risk element was put back in...It’s a huge shift” (RISE team member).

Interviewees related that this redefinition initially sent shockwaves throughout the program’s culture as those working in the operational units were uncomfortable with this change in mission success.

“I will tell you that not everybody is comfortable yet, okay. So, there are a lot of implications there, especially from the operations directorate. Their whole motto from Apollo all the way through, is failure is not an option. And we’re telling them, yes, it is. Your definition of success changes. Success is enabling scientists to make discoveries. Success is enabling scientists to perform their experiments. Keep the laboratory up and running. It’s not saying that it all goes perfectly, okay. So, this is difficult, a really difficult concept for a lot of people to understand” (Lead change agent).

### ***Reprogramming organizational vernacular***

Edgar Schein (2004) identifies the creation of a common language and categories of meaning as an issue of internal integration explaining that “to function as a group, the individuals who come together must establish a system of communication

and a language that permits interpretation of what is going on” (p. 111). For the ISS program, the RISE team took the deliberate decision to change the language and vocabulary used by actors in an effort to shift mind-sets towards being flexible, supportive of scientific experimentation and provide a better communication interface with scientists, thus highlighting the significance of adjusting language and meaning to create a cultural context conducive to its emphasis towards science discovery. It was not enough to change the meaning of terms but the terminology and words themselves were important for the RISE team for it was not just meaning that was seen to carry value but also the label of the term itself.

“We made a very conscious decision about changing the words that we used and bringing in new vernacular. Because when you do that and you use different words, you get outside of your own brain. And so we did it on purpose and so when I hear people talk about well, ‘that’s just that process, or that’s just that process’. No! This is what it’s called [referring to the new terminology being implemented]. It has a different meaning [so we’re fundamentally trying to change meaning itself]... It’s hard because not only do we have to keep saying it over and over and over. Other people have to adopt it and use it” (Change agent).

The finding also signifies that the exploration-exploitation dimension requires nuances in language and meaning, and differences in language labels are connected to the different dimensions of exploration and exploitation. It reinforces the need to reconstruct a common language in which exploration and exploitation share a domain operationally where actors understand it and warrants its backing.

**ii. Reshaping hard organizational elements**

Borrowing Gibson and Birkinshaw’s (2004) conceptualization of hard elements (discipline and stretch), the study identified performance management features the RISE team employed to motivate individuals, in the new context, to perform and “deliver high-quality results and making them accountable for their actions” (p. 51). Having redefined its value system and soft elements the RISE team sought to stimulate the necessary delivery behaviors conducive for effective ambidexterity at the individual level by engaging in organizational features equivalent

to hard elements. In order to empower ground level staff to decide for themselves how to manage their activities between exploration and exploitation, the RISE team reengineered the key processes and enabling processes governing operational activities that needed to change – so to support the cultural change designed to enable ambidexterity, hard structural elements, processes, also needed to change.

“To do process reengineering properly, you have to completely divorce people from process. We had to focus on the processes that were required to realize the vision, the WHY, of ISS, regardless of what organization people resided in in the program. Later we talked about what we would need to realign for the people to better fit with the core and enabling processes” (change agent)

### ***Redesigning critical processes framework and shifting locus of process change decisions***

RISE intended to provoke a deeper degree of cultural change by changing how people behaved in their everyday work, “in order to change our cultural norms we must change how we do our daily jobs” (Change agent). To this end the RISE team identified and redefined what they referred to as the program’s core enabling processes, the core capabilities which, though critical for the effective discharge of operations, were adjudged to be distinguishable from and eclipsing of the ISS program’s *raison d’être* as the RISE change agent illuminated: “Most of our core capabilities exist in our enabling processes. We know how to manage risk. We know how to talk someone through the safety process. We know how to write requirements. We know how to verify hardware for flights ... those core capabilities support us and they are the necessary evils if you will that make everything work. But we don’t exist to be safe. We don’t exist to review requirements. That’s what we’re good at but that’s not why we’re here. And so we thought about it as the big ‘why?’”

In addition, the RISE team identified and introduced specific ‘enablers’ - tangible resources permitting the workforce to execute activities and deliver products in line with the new strategy (i.e. tools, procedures, forums, people, training and reward systems). For the RISE team, these enablers were considered change devices that could empower personnel from the ground up to fulfil their tasks differently and more effectively, helping to transform the program from an assembly focused mindset to one that prioritized science discovery and commercialization.

“We started from scratch and so, what we did map were the issues. So, we mapped the existing issues that we had gathered from [science users] customers as well as from [science] people in the program. We mapped issues to the existing processes and then we remapped them after we designed them to the new processes to see where the disconnects were, where we needed to really dive in and make a change. And those changes are really, we call them enablers. They are tools, tangible products that, and this is kind of our coined phrase, ‘make the right thing to do the easiest thing to do’ ” (Change agent)

A critical feature of the redesign process focused on creating a framework of enabling processes as a mechanism that pushed decision making authority on task related changes down to the level of enactment at ground level staff: “... And so part of the issue that we grapple with in space station is getting empowerment down into the lowest level working troops so they can go do the job that they were hired to go do, okay. And so some of our enablers that we put together, the lowest level “how’s” if you will, are designed to empower these people. So that allows them to make the change that’s in line with this” (Change agent)

Interviewees indicated that due to the extensive size and complexity of the ISS Program RISE did not address all of the enabling processes on a gradual level but focused on the ones key to supporting science innovation that were critical to creating a mindset orientated towards science and the needs of scientific user. Areas the program struggled with the most. Having defined the program’s core purpose and key processes the team focused on detailing the intersections between science related processes and engineering operational processes. This served to ensure processes were aligned to the broader contextual framework, and combined elements needed for exploration and exploitation activities:

“We [RISE middle managers] defined what our [the ISS program’s] core processes are, why does space station exist, why do we do it, who are the customers [scientific users of the ISS]? We then could look at it from the big picture, how are all of our processes interrelated, what are all of the inputs and outputs for everyone and that became our new requirements set for building the rest of our processes and trying to figure out how all of the issues we’re seeing today

mapped to existing processes, boards, panels, whatever; and remapped them to the new redesigned processes” (RISE change lead)

***Redefining performance management boundaries***

Early on, in the RISE initiative, the change team integrated RISE objectives into the formal personnel review process making it a priority in every individual’s performance expectations. Integrating RISE into the formal review process gave gravity to the RISE mission and helped to ground change into the mindset and day-to-day behaviors of individuals across the program. This was a huge deal because the program’s culture was geared towards performance assessment plans; and what’s more, at the time there were 300 civil servants in the Space Station program and every single one of them had a RISE objective incorporated into their performance expectations plan.

“I should tell you this because this is key. Last spring [2014] we wrote in every single – there are 2 to 300 people at the space station program – every single performance review, what we call performance expectations, has RISE in it... And so that’s very top-down. You have to go do this.” (Change agent)

For the ISS Program and the wider JSC community individual performance reviews are a cornerstone of the organizations performance management procedure and culture with one interviewee expressing that “performance reviews are a big deal here”. In incorporating RISE objectives into the central performance review process RISE became embedded into the program’s formal governing systems and provided a mechanism through which behaviors could be monitored and adapted to fit with the overall strategy and the simultaneous push for science innovation and engineering execution:

“Their [staff] position description and how they do their job everyday tells them what they’re supposed to go do, that’s what they’re supposed to go do. People usually follow the rules. So, until you tell them, you’re empowering to be creative and figure out a better way to do it, they’re not going to do it” (RISE lead).



It became apparent the redesign of the program's hard and soft elements was undergirded by these micro foundational elements – break out structural differentiation and the endorsed informal practice of circumventing.

**Microfoundations to seizing and mobilizing resources: unconventional structures and practices (positive deviance) directed from ‘the middle’**

*i. Strategizing directed by middle management: translators and boundary spanners:*

The study found that having sensed and identified the challenges and the opportunity for change, the middle managers seized the opportunity to trigger and direct change by molding a context-reshaping capability. The study identified that seizing and mobilizing was triggered and directed by middle managers who functioned as translators of management's strategic vision for the program (Floyd and Woodridge, 2000), taking it from the abstract high level into the program's functional reality. Hence, middle managers acted as boundary spanners on multiple levels: strategy-operations, upper management-low level staff, and existing operating cognition-new ambidextrous cognition.

To address this opportunity the ISS program director approved the change proposal presented by the middle managers and commissioned a lead change agent from amongst the group of middle managers to form a team (which came to be called RISE) to strategize and transform the program to bring alignment between its ambidextrous vision, processes and behavior. The RISE team lead selected ten middle managers from various office across the program, forming a cross-functional integrated team each possessing a different knowledge base and capabilities set. A conscious decision was made to exclude senior managers and their deputies from the RISE team and instead engaged only middle managers to overcome the internal contextual issue of bi-directional dissonance.

“So, when we set up the team, yeah we didn't have – there were no deputies [refers to senior manager deputies] on the team. We went down to this level [middle managers]. And really at that point it was a conscious decision because the deputies, they don't know enough about what's going on down here [referring to ground level workers, those below middle managers] to have those discussions, right. But these

guys [referring to middle managers] know enough about what's going on up here [referring to upper management] and also what's going on down here [referring to lower level workers]" (RISE team lead)

*ii. Transient structural and spatial separation*

Structural and spatial separation are modes of differentiation featured in ambidexterity. The former relates to the separation of structural forms, processes and systems in an organization and the latter refers to physical separation across time and space, including geographic proximity where elements are in different locations (Jansen et al, 2009). In applying this concept, transient structural separation refers to the creation of a temporary unit, structurally separated from the body of the organization for a term and then assimilating the unit back into the organization. And transient spatial separation is the relocation of a unit to a geographical location different to the main body of the organization for a short-period of time, and then integrating it.

The study found a micro-feature that enabled middle management to design, plan and develop the cultural change required to support the program's ambidextrous strategy was the transient structural and spatial separation of the RISE team which broke out from the rest of the program for a set time period. At the insistence of the change lead, and with authorization from the program director all ten members (middle managers) of the RISE team were deliberately pulled off their routine day-to-day jobs, processes and their department functions for 100 percent of the time, and were geographically relocated to a different building. The separation divorced the team structurally, functionally and culturally from the rest of the ISS program allowing the RISE group to create an environment as a distinct unit where they focused on exploring and designing the context-shaping capability and processes that would see science exploration and the needs of ISS science users actively prioritized and engaged within the operational engineering processes of the wider program.

"I was very insistent on finding the right place for the team to meet away from their jobs. I did not want the team in the same beige... stale environment. I needed a place for people to get their creative juices flowing. I worked with [JSC] center facilities to have full use of a brand new collaboration facility before it even opened

to the [rest of the organization]. I needed people to think differently, and they cannot often do that in the same environment” (RISE Lead)

By separating the change agents from the rest of program the RISE team lead intentional sought to avoid the difficulty that comes with switching between activities when having to divide one’s time and commitment between the busy routine activities of a day-job and the entrepreneurial thinking and exploration required to formulate a new change strategy as a side project, as the RISE lead pointed out: “everything is so busy in the office. People had been trying to make changes for years and we weren’t getting anywhere... And so, part of it was the focused, dedicated time to go really look at it from the top down. We needed to have it [a separate space away from the program], because inevitably what would happen is that day to day work would overtake and people wouldn’t spend the time on it [exploring the strategy for change]”. Although switching between explorative and exploitative activities had been a mechanism previously employed by the ISS program to engender change it had proven ineffective because the exploitative routines of daily activities dominated time and thinking, gradually nudging out scope for exploration. Furthermore, what made the RISE team different from other project-focus teams (i.e. tiger teams) was its complete focus on redefining organizational and cultural aspects of the program. This non-technical focus was markedly different to the change/problem solving project teams historically used by the program.

*iii. Loosely coupled structures (unconventional)*

The term loose coupling connotes elements and systems being “tied together either weakly or infrequently or slowly or with minimal interdependence” (Weick, 1976: 5), and provides a solution to problems that maybe costly in tightly coupled systems. In application to this study, loose coupling refers to an independent organizational unit that is structurally separate from the rest of the organization, is empowered to operate differently to the rest of the organization has limited interaction with other organizational members outside of its unit. For the ISS program, this structural arrangement constituted an unconventional approach as it was different to the routinized, process orientated and directed way of operating followed by the rest of the program.

The data found the use of loose structural coupling for the RISE team was a positive contributory factor. Being structurally separated from the program, the RISE team who consisted entirely of middle managers, were intentionally placed outside of the program's hierarchical chain of command, which further differentiated the RISE unit from the broader program and enabled the group to explore and develop the context-reshaping capability independent from the program's operational activities. Having the support of the program's executive director, the team reported directly to the executive director of the ISS thereby circumventing several layers of upper management – including their own line managers; “we essentially were working on behalf of the program manager. We did not report to our managers at all” (RISE Lead). This arrangement allowed the program director to monitor RISE strategic development and gave them the director visibility of workings on the ground.

The study found that in structurally circumventing upper levels of management, the RISE reporting structure exercised an informal practice and assumed a ‘strategic leadership’ position in reporting and communicating directly and strictly with the program director. The direct support of the director legitimated the informal reporting practice creating a dual management structure. One that reflected the formal structure and functional flow of the organization that was focused on maintaining the program's stability. The second pseudo like leadership team being the RISE middle managers were charged with exploring and designing a strategy to take the organization forward and forge the processes, systems and cultural features needed to enable the effective operation of science innovation and functional maintenance of the ISS vehicle.

“We were given full [strategic] design freedom from the beginning, and authority [from program director] to look at the solution set however we saw fit. We were given no boundaries aside from keeping the crew and vehicle safe, and retaining the organization structure, which we still made recommendations to change” (Change agent).

### **(c) Reconfiguring, enhancing and combining**

#### **Semi-autonomy from the ground up**

Reconfiguration, Teece (2007) explicates “is needed to maintain evolutionary fitness...In short, success will breed some level of routine, as this is necessary for operational efficiency. Routines help sustain continuity until there is a shift in the environment” (p. 1335). In the case of the ISS program and the RISE initiative, the study found the ability to reconfigure and maintain the change operationally going forward occurred on three interrelated levels – ground level, middle management and senior management.

At ground level, as a consequence of RISE and the development of a context-reshaping capability, going forward low-level employees were empowered to explore, identify and decide how to make changes on a granular level to specific operational tasks and processes for which they were responsible or directly involved. The RISE context-shaping capability created the framework boundaries and expectations within which low-level workers had to operate, and it simultaneously decentralized an element of change decisions by giving workers semi-autonomy and ownership of the changes in their work activities – in other words long-term incremental task changes would become a routinized action from the bottom up – a point exemplified by the following interviewee comment:

“What we did, in the whole philosophy and the purpose of RISE as the team, was to build that framework and then we hand it over to the people who own that work, and we give them the expectations. Here’s, here are the values. Here’s the enablers that we’d like you to go put in place. Here are the things we want you to tackle. It’s theirs to go figure out how. The people who own the work today are the ones who are going to go update how they do it ... [we] empowered them to make that decision... [we] changed who the decision makers were” (Change agent)

The RISE context-reshaping had been initiated, designed and implemented by middle managers. The data suggests that in developing this capability, the group established a framework inside which the program’s intangible cultural and tangible processes and structural features were recrafted. Having spent four months designing

the context-reshaping capability most of the RISE group members purposefully returned to their regular ISS Program offices but continued to work on the RISE initiative in a refining and implementation capacity. In moving the developers of the context-reshaping capability back to the program and into their routine jobs, the role of the middle managers shifted to integrators of the context-reshaping capability, able to translate the strategy into practice within the structural constraints of their distinct program office; and in the long term these actors served as an embedding mechanism close enough to observe and oversee task related changes occurring at the lower-levels.

“I [RISE team lead] took their [upper middle managements] best people for 4 months, and I knew when I came out, I was going to need their [upper middle management] help to implement this. Not only their help but they have to do it ... I needed [RISE] people to go back to their jobs so their managers could see them. So, they [RISE members] could start integrating and influencing and bringing in the vocabulary and the changes and everything else”  
(RISE team lead)

Notably, the RISE team lead did not return back to their routine program job role but remained in this role, and for the next two years continued to spearhead the context-reshaping capability process and its effectual change. Critically, the RISE team lead was elevated to ISS program management status which endowed positional power to ensure continued renewal “... because program management put me up on staff I have been able to direct a lot of changes”. Thus, corroborating with extant literature on the significance of senior management in directing long-term change and authorizing the reconfiguring of resources. Due to RISE, the ISS program underwent effective change which enabled the dual pursuit of science (exploration) and engineering (exploitation). An example of the RISE’s success in enabling science exploration and executing operational efficiency is seen in the DNA sequencing project which went through the new processes, structures and cultural behaviors developed through RISE. It resulted with the scientists and JSC ISS program winning a prestigious award for producing revolutionary science:

“NASA’s Johnson Space Center and Oxford Nanopore Technologies’ MinION™ DNA

sequencing team were honored with the prestigious Arthur C. Clarke Award [...] The sequencing project was a part of Johnson's 5x2015 initiative, created ... to send exploration prototypes to the International Space Station (ISS). This initiative tests a streamlined development process for flight projects [RISE]" (JSC Features, 2016; 2017).

## DISCUSSION

This paper set out to examine how an organization engages different antecedents in managing exploration and exploitation activities simultaneously, and what organizational features contribute to this development? Extant literature posits that an ambidextrous organization is achieved as a result of both structural and contextual solutions; however, to date research articles examining ambidexterity have tended to focus upon one antecedent solution rather than examine the combined use of modes, thus providing a limited understanding of how these approaches are employed integratively (Agostini et al, 2016; Simsek, 2009). Employing a longitudinal case analysis of the ISS space program – a large organizational unit at JSC – this study examines its development in managing science research (exploration) and engineering (exploitation), and provides empirical insights to address this question. As such, it offers an enhanced understanding of how ambidexterity 'works in practice', and the underpinning mechanisms engaged.

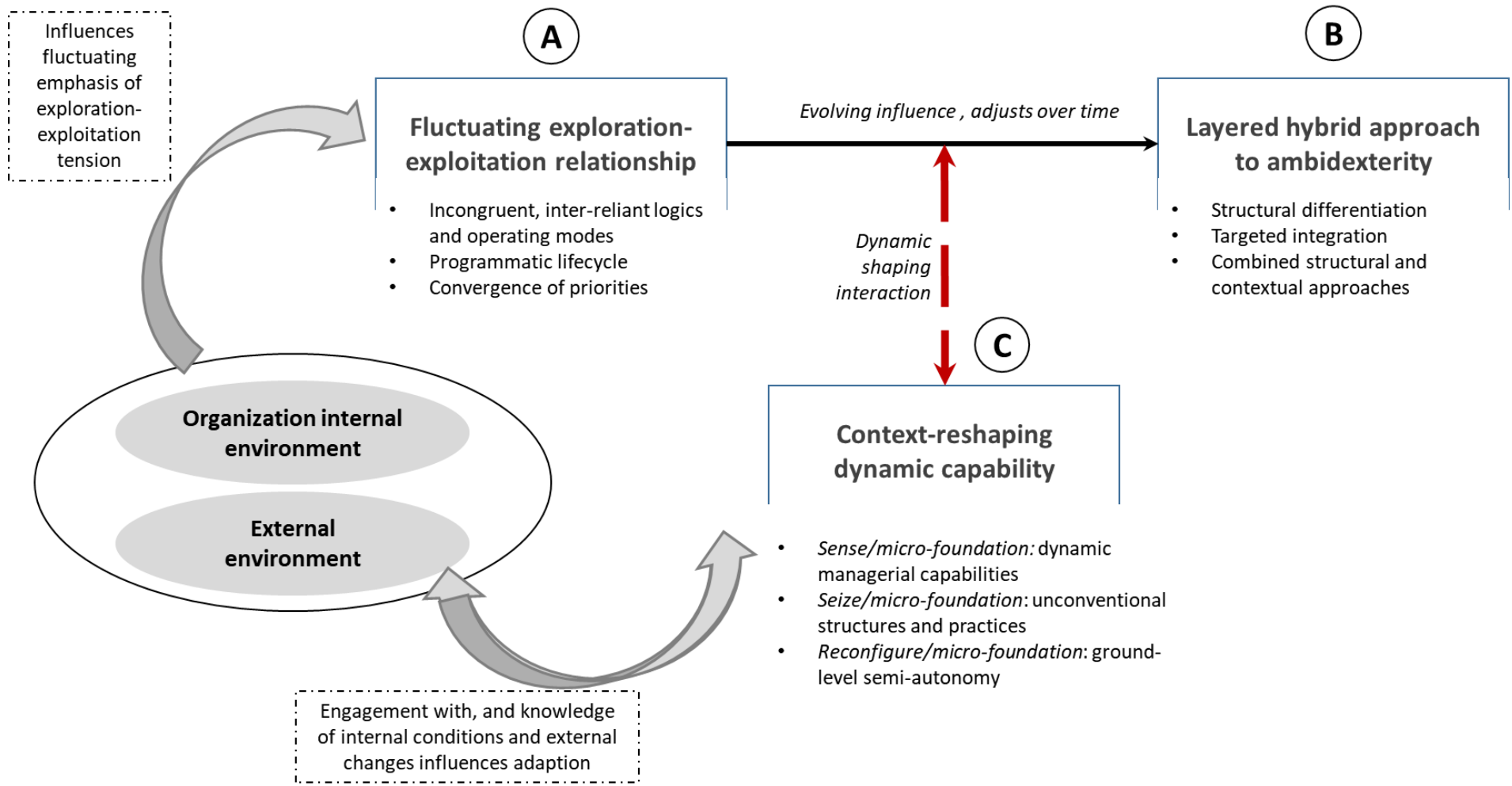


Figure 2: Framework of dynamic exploration-exploitation tension and the evolving hybrid approach to ambidexterity



The main theoretical insights emerging from this study concern the dynamic emphasis and allocation of resources between exploration and exploitation, and the micro-mechanisms, structures and processes engendering an organization's pathway to becoming ambidextrous. The study provides an alternative perspective of how antecedents to ambidexterity may be engaged in an integrated manner, showing a progressive layering pattern culminating in a fused hybrid approach to ambidexterity. In sketching an organization's pathway to effectual ambidexterity, this paper contributes to understanding how the shift towards an ambidextrous strategy can constitute a change in an organization's paradigm and requires the combined engagement of structures, cultural features and micro-mechanisms in establishing ambidexterity. It combines theoretical concepts and empirical insights from ambidexterity literature, dynamic capabilities and organizational change to analyze how an organization becomes ambidextrous, the approach it employs, the underlying factors that give rise to it, and the mechanisms that support and hinder its transition process. The study helps to address a gap in our understanding of how the various approaches can be used interrelatedly and highlights the complexity inherent in the process and the organizational features that engender the interrelations.

Figure 2 presents an empirically-grounded framework of the three core concepts critical to understanding the manifestation of ambidexterity in practice - *fluctuating exploration-exploitation relationship*, *layered hybrid approach to ambidexterity*, and *context-reshaping dynamic capability* – and demonstrates the relationships and direction of influence between these concepts.

Conceptions of temporal, structural and contextual ambidexterity are well documented, yet the collective application of these constructs to a multi-level organization or functional unit requires further attention (Turner et al, 2013). Current empirical studies favor structural approaches to ambidexterity, quantitative empirical analysis, and give limited attention to the (micro) mechanisms that underlie and enable the pursuit and eventual achievement of ambidexterity.

### **Fluctuating exploration-exploitation tension (A)**

The first core concept, represented as (A) in figure 2, centers on the nature of the exploration-exploitation tension. The findings show that nature of the relationship between the explore-exploit dimensions plays an important role in understanding the approaches employed by the organization to manage ambidexterity.

Finding and maintaining an appropriate balance between exploration and exploitation activities is considered a key feature to operating ambidextrously (March, 1991), and by 'appropriate' academic logic has largely been nondescript in defining its magnitude, referring to terms such as achieving 'high levels' (Lubatkin et al, 2006; Agostini et al, 2016) or being relatively evenly balanced (Lavie and Rosenkopf, 2006). Although March (1991) does not define or clarify what the appropriate level should look like, researchers have implied and suggested the appropriate level for ambidexterity to be the 'balance' of exploration and exploitation. This perspective suggests the exploration-exploitation tension maintains a static constant form (Lewis et al, 2017), persisting strategically and operationally. However, findings from the study highlight a somewhat different view of the nature of the exploration-exploitation tension. The data indicates that the nature of the explore-exploit tension is not static or constant over time, nor are exploration and exploitation activities pursued to the same magnitude or degree over time, but appears asymmetric (Lee, Kim and Joshi, 2017). The findings demonstrate that the 'balance' of exploration and exploitation can be mutable, in that both dimensions are simultaneously in operation but rather than exist in a state of balance the study finds that the degree of emphasis given to the dimensions fluctuates at different levels (i.e. individual tasks, wider program); and this dynamism is context dependent. In the case of the ISS program, exploration and exploitation were deemed significant but did not carry equivalent emphasis at the same time but was in flux. The shift in emphasis over time towards one element depending on environmental factors and changes to its internal context.

However, the shifting nature did not take the form of cyclical or sequential cycles, with one dimension of the tension replacing the other over time as offered by the temporal approach to ambidexterity (Boumgarden et al, 2012). Both dimensions were functionally active and required management simultaneously. However, the 'appropriate level' and emphasis given to exploration and exploitation, as per resource allocation, management's focus and employees operating behaviors, shifted between the two dimensions. As such, it recasts the idea of dynamic ambidexterity (Luger et al, 2015) and temporal separation (Siggelkow and Levinthal, 2003) by stressing the fluctuations between exploration and exploitation which may occur in its operational emphasis and magnitude in addition to time and organizational lifecycle, and that these shifts in magnitude can constitute a dynamic character.

Figure 3, provides a graphic illustration of what the shifting emphasis between exploration and exploitation could look like in comparison to the traditional temporal/cyclical perspective of the exploration and exploitation tension and ambidexterity. For example, the organization is continuously engaged in both exploration and exploitation activities but at t1, exploration has a greater emphasis, but in t2 the emphasis switches to exploitation. This study's contention that the 'appropriate level' for balance can be dynamic empirically embraces Raisch et al's (2009) assertion that organization's may move from a primary emphasis on one dimension of a tension towards another. It also corresponds with Markides et al's (2017) 'oscillating pendulum' approach and provides support to Gulati and Puranam's (2009) claim that the balance of exploration-exploitation activities depends on its relative importance to the organization. In the case of the ISS program, these fluctuations were conditioned by context dependent priorities and the organization's dominant operating logic rather than strategic intent, all of which were contingent upon the national political agenda, its internal and external environment and evolving strategic objectives for the program. The study's findings would suggest the continuous maintenance of exploration and exploitation in 'balance' may be unsuitable and ineffectual under certain circumstances. Nor does it necessarily reflect the reality seen in practice, particularly when an organization's activities are subject to programmatic/project or development lifecycle phases, or in cases where the organization's strategic agenda is prone to changes.

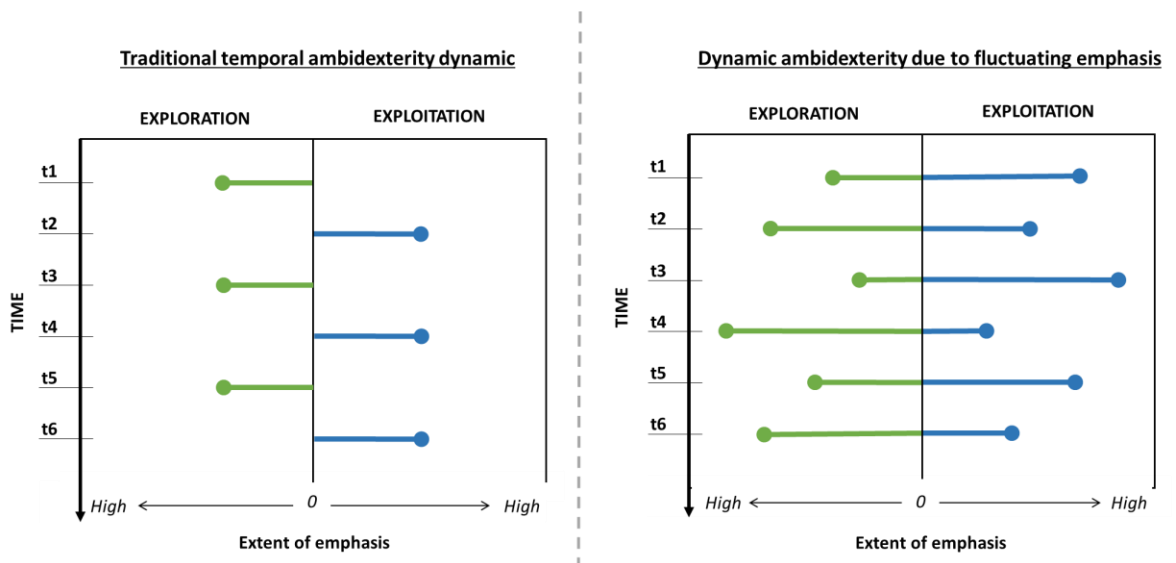


Figure 3: Illustration comparing traditional view of temporal ambidexterity and dynamic ambidexterity based on fluctuating degrees of organizational emphasis between exploration and exploitation

### **Layered hybrid approach to ambidexterity (B)**

The second core concept, represented as (B) in figure 2, refers to the evolving hybrid approach the organizational unit employed over time to manage exploration-exploitation ambidextrously. In combining the different antecedents, the form and character they assume alters appearing to recast what has traditionally been depicted, leading to an alternative perspective and understanding of how ambidexterity may be achieved. To this end, the study finds that this hybrid mode to ambidexterity was borne out of the fluctuating nature of the exploration-exploitation tension (concept A).

The dynamism in the exploration-exploitation tension renders its management more complex than presented by the static antecedent models proposed in literature. Drawing on contingency theory and the efficiency-flexibility tension, Ebben and Johnson (2008) contend that “efficiency and flexibility can be viewed as pure or ideal configurations, while a combination of efficiency and flexibility would require a hybrid configuration” (p. 1251). The authors go on to argue that the hybrid configuration needed to operate efficiency and flexibility possess inconsistent organizational attributes; a view seemingly shared by Raisch et al (2009) who contend that combining differentiation and integration processes “creates a paradox that is difficult to resolve” (p. 687). However, data from the ISS RISE case demonstrates that a fused configuration is possible and does not necessarily produce distinctly inconsistent organizational attributes. The findings show that the ISS program’s structural separation of engineering (exploitation) and science (exploration), exemplifying a structural separation did not allow for the effective management of the dynamism and oscillation between engineering and science which defined the ISS program’s strategy and function. Instead it produced organizational attributes that were un conducive to the program’s exploration and exploitation dynamic. Consequently, this finding highlights a limitation in the structural separation approach to ambidexterity. Current prescriptions of this approach maintain a separation of exploration and exploitation respective of the relationship between the two dimensions of the tension; nor does it account for the possibility that the relationship between the two dimensions may evolve and change over time from a state of conflict to one of convergence and synthesis. The fusion approach combining differentiation and integration, as identified in the ISS case study, reflects an interweaving akin to Smith and Lewis (2011) dynamic equilibrium model which invokes the idea of managing paradox through ongoing

micro-shifts, a proposition similar to the ISS program's progressively fused approach to managing exploration and exploitation effectively.

For the ISS program, in an effort to bring forth better alignment between the engineering and science domains, senior management pierced the structurally separate domains with an element of integration by placing responsibility for certain science orientated processes and tasks within engineering offices; an act resembling Tushman and O'Reilly's (2013) targeted integration concept. This semi-integrated structural approach was overlaid over the program's original structural differentiation approach. In sharing structural elements, combining these two approaches did not represent a radical disruption to the organizational unit. The disruption was found to be more localized and orientated around work processes and routines tailored to exploration and exploitation.

However, over time this targeted integration approach was insufficient in resolving inconsistencies in the program and effectively managing the explore-exploit activities. Though management devised a program wide shared vision (O'Reilly and Tushman, 1996; 2004) this proved ineffectual in translating the strategy to operations on the ground. In the ISS case, the study found the intentional creation of what I term '*cross-boundary contextual integration*' amidst structural units, which are chiefly discrete, enabled the fusion of structural differentiation and contextual integration. This cross-boundary contextual integration represents the adoption of a third approach and was integrated with the existing targeted integration approach. Cross-boundary contextual integration refers to the contextual integration approach of Gibson and Birkinshaw (2004), whereby a cultural environment was designed through the ISS RISE initiative which made seemingly incompatible processes and operating logics compatible and developed a shared understanding between the engineering (exploitation) and science (exploration) divisions. In doing so, it altered actors' perceptions of the exploration-exploitation dynamic, whereby engineering and science were reconciled and compatible operationally as well as strategically and accommodated for the oscillating dynamism in the program's exploration-exploitation activities. However, this form of contextual integration occurred whilst the organization still employed a degree of structural separation – hence contextual integration needs to cross the boundaries of structurally separate units. It represents a further hybrid approach in merging structural differentiation and contextual integration.

According to Gibson and Birkinshaw (2004), the interaction of Ghoshal and Bartlett (1994) four attributes – discipline, stretch, trust and support – form the organizational context that shape and engender individual-level and collective behaviors which enable ambidexterity over time. Evidence from this study of NASA's ISS program found additional mechanisms not fully captured by Ghoshal and Bartlett's four attributes were critical to developing the context required to create an environment that enabled the ISS program to behave ambidextrously. Findings from the case study found that the change team pursued an approach that first re-established the program's contextual soft elements and then translated these to its hard contextual elements, thus recrafting its contextual environment. Gibson and Birkinshaw's (2004) conceptualization of soft elements (the combining support and trust) are said to provide the social support dimension of an organization's context, providing individuals with "the security and latitude they need to perform" (p. 51) allowing actors individual freedoms rather than exercising formal authority to enable ambidexterity. The study found that in order to create a social support system that empowered actors with the freedom to direct their behaviors to perform ambidextrously, the organization had to establish parameters in which soft elements could be exercised in a manner conducive to the new ambidextrous context in which is sought to establish. In other words, the soft elements were conditioned by a new set of cultural parameters redefined by the RISE change team in order to ensure that the freedoms and latitude exercised by actors adhered to supporting and emphasizing scientific research alongside operational routines, and did not fall back into the program's traditional dominant logic and emphasis of engineering capabilities.

Furthermore, the findings highlight the role of language and vernacular as a supporting mechanism in accommodating an ambidextrous strategy. However, the significance of language and reconfiguring it in the context of ambidexterity is underexplored in literature. This opens the door for further study as to the role of language and its impact in an environment in which exploration and exploitation must coexist and yet where terminology of processes has held different meaning. What is the cognitive impact? The significance of discourse in generating an ambidextrous environment – significance of deconstructing and configuring discourse for discourse simultaneously forms part of the structural and contextual fabric of the organization. It forms part of the structural element in that the formal systems and processes engaged in establishing ambidexterity take on a different form and different meaning.

And in terms of the contextual element, language forms a part of the intersubjective experience and mindset of the employees and in changing vernacular the cultural mindset may be impacted. Learning to become ambidextrous requires a new way of thinking, behaving and speaking.

### **Context-reshaping dynamic capability (C)**

The third core concept, represented as (C) in figure 2, refers to the dynamic context reshaping capability that influenced and shaped the solutions pursued by the unit.

The dynamics capabilities perspective contends “the key to ambidexterity is the ability of the organization to sense and seize new opportunities through simultaneous exploration and exploitation” (O’Reilly and Tushman, 2013: 238), a capability they contend rests critically with leadership. However, this study recasts the role of middle managers in the strategy process, in relation to organizational ambidexterity, and highlights their role in not only executing the strategy but in designing and developing the approach to effectively manage exploration and exploitation simultaneously. The ISS case demonstrates the key role of middle managers in contriving cross-boundary contextual integration and reshaping the program’s soft and hard organizational features which was critical to forging the fused differentiation-integration approach employed by the ISS in managing engineering and science ambidextrously.

The research study contained within extends our understanding of dynamic capabilities and dynamic managerial capabilities as features demonstrable by middle managers and the significance this can have on shaping and enabling the effective operation of exploration and exploitation. By strategizing from the middle, the ISS program overcame the constraints of cognitive distance and dissonance, highlighting the significance of middle managers in reducing strategy ambiguity and their contribution to designing and translating an ambidextrous strategy into reality on the ground by virtue of the insights they gain from their structural position (Wooldridge et al, 2008). Thus, middle managers can play a central role in facilitating ambidexterity and reshaping internal processes, systems and context.

Another important feature associated with the hybrid mode is the informal organization – namely the knowledge and skills developed as a consequence of

informal network relations and the use of unconventional structures and practices. The application of informal processes and structures present within the case study highlights its significance for organizational and strategic routines (Eisenhardt and Martin, 2000). It also suggests the informal organization is an enabling mechanism in crafting a hybrid fused approach to ambidexterity. Thus, the findings contribute to broadening our understanding of the significance of unconventional practices, and the informal organization more broadly speaking, as an enabling mechanism contributing to the manifestation of dynamic capabilities in unconventional setups.

Similarly, the role and influence of executive managers and top management teams on ambidexterity has been studied. Relatively little has been demonstrated from a 'middle management perspective' (Wooldridge et al, 2008) regarding the role and influence of mid-level managers in managing and orchestrating exploitation and exploration towards ambidexterity. It emerged that middle managers play a critical role in initiating, designing and driving the shape of this hybrid mode to ambidexterity, and what's more, the micro-processes of dynamic capabilities – sensing, seizing and reconfiguring (Teece, 2007) – were found to reside in and be enacted by middle managers. It emerged that what enabled these dynamic capability traits to manifest at the middle management level was (1) bidirectional cognitive dissonance between senior management and ground level staff, and (2) the deliberate engagement of unconventional informal practices endorsed by the senior director. The study contributes insights into the managerial capability to achieve ambidexterity, highlighting the significance of middle managers not only in its initiation, as conferred by Zimmermann et al (2015), but also in its direct design, formulation and implementation. Secondly, the research case contributes to our understanding of where dynamic capabilities can be held in an organization by extending our understanding of how 'reconfiguring', by virtue of context shaping capabilities (Birkinshaw et al, 2016), can occur at organizational levels beyond senior management.

### **Avenues for future research**

This paper's findings open avenues for further research but herein I briefly focus on two that appear to be most promising. Firstly, it demonstrates the dynamism that occurs in the exploration-exploitation tension and how this conditions the approach an organization or unit takes in managing the tension. The analysis helps us understand some of the drivers for the dynamism that occurs between these two



dimensions, and provides an empirical demonstration of how it plays out in reality. However, it would be useful to expand our understanding of the dynamism, its drivers and the organizational contexts in which it arises and the areas in which it does not. Furthermore, studies could examine other organizational tensions to see if this oscillating dynamism between the two dimensions is a condition experienced beyond the exploration-exploitation tension, and what motivates and underpins the dynamics in these tensions.

Secondly, the study explores how different approaches to ambidexterity can be fused and used interrelatedly, however, existing research is limited in looking at the interrelations between different approaches and how differentiation and integration modes can be engaged harmoniously within an organization. Thus, there is value in exploring how different organizations may utilize and combine seemingly incompatible approaches and attributes harmoniously. To further this research one could include a comparative examination of the differences in approaches taken by various organizations, the features shaping their chosen approach and the effect it has on their ambidextrous performance.

# Chapter Three

## The practice of circumventing: interaction of the formal and informal organization as a dynamic capability

### INTRODUCTION

Organizational ambidexterity is allied with the dynamic capabilities concept (Birkinshaw, Zimmermann and Raisch, 2016; Carter, 2015; Jansen et al, 2009b; Jurksiene and Pundziene, 2016; Lee and Rha, 2016; O'Reilly and Tushman, 2008). Both concepts pertain to an organization's ability to adapt to perform competitively within a rapidly changing environment, and centers on aligning internal and external firm specific competencies and routines with changes in its environment (Teece, Pisano and Shuen, 1997). The ability to explore new opportunities and exploit existing capabilities ambidextrously is central to an organization's adaptive process for it requires they exercise the ability to reconfigure structures, processes and competences in line with environmental changes (O'Reilly and Tushman, 2008; 2011). Hence, dynamic capabilities constitute the "distinct skills, processes, procedures, organizational structures, decision rules and disciplines that enable the senior leaders of a firm to identify threats and opportunities and to reconfigure assets to meet these" (O'Reilly and Tushman, 2008: 189). The dynamic capabilities perspective on ambidexterity emphasizes the role of strategic leadership in orchestrating organizational structure, culture and processes to facilitate the dual pursuit of exploration and exploitation (O'Reilly and Tushman, 2008). Thus, central to the concept of dynamic capabilities and ambidexterity is the organizational ability for change and adaptation to accommodate exploration and exploitation activities.

Within literature, studies on the pathways to ambidexterity (i.e. the simultaneous pursuit of exploration and exploitation) are broadly dominated by the structural and contextual approaches and explicitly refer to formal organizational mechanisms such as structure, processes, systems and a deliberately designed cultural environment, as the vehicles enabling the organization to orientate towards pursuing exploration and exploitation simultaneously. Researchers largely contend that senior management's ability to devise or reposition these formal organizational elements are a central feature to achieving ambidexterity. Implicit, however, in the conceptualization of contextual ambidexterity is the notion that the informal organization plays a supporting role in enabling individuals to satisfy the dual demands of exploration and exploitation (Gibson and Birkinshaw, 2004).

The importance of the informal organization in strategy making is becoming widely recognized (Chakravarthy *et al*, 2003; McEvily, Soda and Tortoriello, 2014; Mintzberg 1979), and research on the dynamics of ambidexterity has begun to explore the interplay between the formal and informal organization and how this interaction can engender ambidexterity within an organization (Gulati and Puranam, 2009; Soda and Zaheer, 2012). In defining the informal organization this paper refers to it as 'the emergent patterns of individual behavior and interactions between individuals, as well as the norms, values and beliefs that underlie such behaviors and interactions' (Gulati and Puranam, 2009: 427). Within the strategy process literature, scholars have developed integrative frameworks that offer explicit recognition to the role of the informal organization on strategic decisions and actions (Burgelman, 1983; Chakravarthy and White, 2002).

Although the informal organization is said to define the daily work routines and knowledge flows that are fundamental to an organization's operations and productive performance (Nickerson and Zenger, 2002), exploration of the role of informal organizational practices in the context of ambidexterity and its interaction with formal organizational elements is limited within management literature. There is a gap in our understanding of how formal and informal organizational elements interact and even combine giving rise to unexpected arrangements and/or processes that influence an organization's pursuit of ambidexterity (Gulati and Puranam, 2009). Less is known about informal organizational practices as a dynamic capability mechanism or routine which may support an organization's adaptation process. Furthermore, the emphasis in dynamic capabilities theory and research has been on the ability of managerial actors, and little attention has been given to the role and capacity of non-managerial actors and their potential to exercise and contribute to the manifestation of dynamic capabilities. I would argue that

there is an inherent benefit in examining the informal organization during an organization's transition as it can shed light into how informal practices interact with and influence formal elements, and vice versa (Nohria and Gulati, 1994); and, also contributes to understanding the practical realities and complexity that arise in promoting exploration and exploitation activities when seeking to become ambidextrous.

This study adopts a strategy-as-practice (SAP) approach as it seeks to address the question “*how do emergent informal practices interact with formal organizational elements, and vice-versa, to engender ambidexterity, and does this interaction play a role in contributing towards the organization's dynamic capabilities?*” A strategy-as-practice (SAP) approach suits an examination of how informal elements interact with the formal organization to promote exploration and exploitation activities. The practice perspective focuses on what members of an organization ‘actually do’ (Jarzabkowski, Balogun and Seidl, 2007; Whittington, 2003), studying the processes, practices and social activities that embody the organization (Golsorkhi *et al.*, 2010). DeKeyser (2007) explains that practice involves specific activities that individuals deliberately engage in with the intention of achieving a goal. In the context of organizations, it signifies the activities of organizational members and is essential for the ongoing operations of organizations (Feldman and Orlikowski, 2011). As such, it recognizes the significance of actors and their actions, as well as the broader organizational context of the organization in which they function (Schatzki, 2005; Whittington, 2006).

To address this question, an ethnographic examination of an established organization in the process of transitioning from a focus strategy to an ambidextrous one was conducted. Rich qualitative data (Geertz, 1973) was gathered concerning the practices and activities enacted by the informal organization whilst adapting to an ambidextrous strategy. Using a grounded theory approach the study identifies an emergent informal practice, which I refer to as *the practice of circumventing (POC)*, and represents an unconventional means of supporting change by actively promoting exploration and exploitation activities. This paper defines POC as: the deliberate side-step or jump-over either a formal process, elements within a process, or layers of hierarchy with the intention of achieving change in support of the strategic ambidextrous objective. POC constitutes a set of actions, borne out of the interaction between formal and informal organizational elements. It is important to note that this paper observes the distinction between the terms practice and practices (Jarzabkowski, 2003; Whittington, 2006). References to POC relate specifically to the actual informal activity of people ‘in practice’ – what they do and how they do it (Whittington, 2006). This study advances our understanding for it empirically analyses and gives explicit attention to an

underexplored area by examining the role of the informal organization in the adaptive process of becoming ambidextrous. It also provides an opportunity to explore in practice the dynamics between formal and informal organizational elements and its consequential role in dynamic capabilities, something existing literature has given little attention to. Such an investigation is important since the informal organization constitutes to a large extent the actual practices, knowledge flows and relations that determine the way an organization functions day-to-day; it has inherent implications for strategy implementation, organizational change, and the related mechanisms and outcomes.

This study contributes to our understanding in two ways. Firstly, it provides insights into organizing and strategizing (Whittington and Melin, 2003) in practice by elaborating how elements of the informal organization, through emergent enacted practices, interact with and influence elements of the formal organizational. Secondly, it develops a perspective on how through this interaction informal practices have a dynamic capabilities role and can promote exploration and exploitation activities and, under certain circumstances, can enable long-term change. The research identifies the existence of strategic goal attachment in line with the formal strategy within the informal organization and finds that a lack of strategy specification creates a context in which the informal practice of POC is enacted. In addition, the study finds that the informal organization through POC provides an unconventional flexible solution to perceived weaknesses within the formal organization inhibiting its goal for ambidexterity. Furthermore, the outcomes of POC was found to be mixed but, under certain conditions of high formal authority and informal status, it has the potential to provoke the reconfiguration of resources and engender long-term change in features of the formal organization. This demonstrates that the mode of interaction between the formal and informal can go beyond the supporting and compensatory fit models (Gulati and Puranam, 2009) conceptualized in existing literature. The findings also suggest that the practice of circumventing is a form of proactive behavior, namely positive deviance, actioned by the informal organization whose performative outcomes may contribute to the organization's operational and dynamic capabilities (Teece et al., 1997).

## THEORETICAL BACKGROUND

The theoretical foundations underlying this study stem from the fields of strategic management and organizational behavior. Firstly, the study draws from the dynamic capabilities and organizational ambidexterity research, which implicitly acknowledges the role of the informal organization in conceptual terms, yet has done little to empirically examine or theoretically enrich it. Secondly, it draws attention to the interaction between the formal and informal organization, and its interactive influence on outcomes and behavior.

### **Dynamic Capabilities Perspective and Organizational Ambidexterity**

The dynamic capabilities perspective has been highly influential in ambidexterity research, and studies have sought to integrate the two concepts (Čirjevskis, 2016; Lee and Rha, 2016; Harreld, O'Reilly and Tushman, 2007; Vahlne and Jonsson, 2017). Dynamic capabilities are said to be “at the heart” of an organization’s ability to be ambidextrous (O’Reilly and Tushman, 2008: 190). Some scholars emphasize the existence of a set of universally effective dynamic capabilities applicable across organizations (Teece, 2007; Eisenhardt and Martin, 2000), whilst others argue that dynamic capabilities are idiosyncratic and are therefore contingent upon and conditioned by the context in which they operate (Birkinshaw et al, 2016; Winter, 2003). Teece, Pisano, and Shuen (1997) define dynamic capabilities in terms of competencies that generate an alignment with a shifting environment and refer to it as “the firm’s ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (p. 516). While Helfat et al (2007) emphasizes the augmentation of an organization’s resource base, referring to “the capacity of an organization to purposefully create, extend, or modify its resource base” (p.4), where the term ‘resource base’ comprises of “tangible, intangible, and human assets (or resources) as well as capabilities which the organization owns, controls, or has access to on a preferential basis” (Helfat and Peteraf, 2009: 94). Importantly, Teece (2016) emphasize that an organization’s dynamic capabilities direct *how* it “integrates, builds and reconfigures internal and external competencies” as it attends to changes in its environment (p. 18).

Ambidexterity is itself classified as a dynamic capability for it “embodies a complex set of routines including decentralization, differentiation, targeted integration, and the ability of senior leadership to orchestrate the complex trade-offs that the simultaneous pursuit of exploration and exploitation requires” (O’Reilly and Tushman, 2011: 6). This paper adopts March (1991) definition of ambidexterity as an organization’s ability to simultaneously

pursue exploration including “search, variation, risk taking, experimentation, play, flexibility, discovery, innovation” and exploitation involving “refinement, choice, production, efficiency, selection, implementation, execution” (March, 1991, p.71).

According to Teece (2007, 2012, 2016) the necessary organizational processes that constitute dynamic capabilities can be categorized as the ability to: (1) sense and identify opportunities, trends and threats in the changing environment, (2) *seize* the identified opportunities and threats by mobilizing resources to execute possible chosen actions, (3) *reconfigure* resources, be it through integration or enhancements, to transform the organization in alignment to the changing environment and generate continual renewal of core competences (Teece, 2007; Teece et al, 1997). Correspondingly, O’Reilly and Tushman (2008) contend that these processes – sensing, seizing and reconfiguring - are necessary if ambidexterity is to be successful. These three processes or capacities are underpinned by what Teece (2007) refers to as the microfoundations of dynamic capabilities. These microfoundations are deemed to be “distinct skills, processes, procedures, organizational structures, decision rules, and disciplines” (p. 1319), and as a framework captures a host of embedded managerial and organizational elements that provide for and enable dynamic capabilities and generate change. Arguably, these embedded managerial and organizational elements are features, processes and structures pertaining to the formal organization as well as the informal organization and therefore in studying and elucidating these dimensions we can hope to gain a deeper understanding of the nature of dynamic capabilities and their micro-foundations. Furthermore, extant literature gives little attention to whether the informal organization has the potential to contribute to dynamic capabilities or its underpinning micro-foundations and how such a development may transpire. Though extant literature makes no explicit distinction as to whether the micro foundational elements of dynamic capabilities are formally designed and operated mechanisms or informal, unofficial and non-directed, this ambiguity does not exclude the possibility that the informal organization and informal practices can contribute to and play a micro-foundational role in dynamic capabilities and ambidexterity.

## **The Formal and Informal Organization**

Since its early development, management theory concedes that an organization’s function consists of more than the formally prescribed rules, structures and official network

ties to which it conforms. Its official blueprint does not fully determine the everyday practices and social relations of an organization (Blau and Scott, 1963). Everyday operations are driven by the informal organization, patterns of interactions between employees that deviate from formal prescriptions, structures and norms underpinning these interactions (Gulati and Puranam, 2009). However, current research has tended to focus on examining the formal organization and/or the informal organization in isolation, focusing on one dimension exclusive of the influence of the other. Seldom has the interaction between the formal and informal organization been examined empirically from a practice perspective, particularly within ambidexterity literature; nor have its implications on actor performance been expounded upon (Soda and Zaheer, 2012). Very few studies explicitly account for the interaction between formal and informal organizational components and its role in engendering ambidexterity (Gulati and Puranam, 2009); and its effect on the performance of individuals (Kleinbaum, Stuart, Tushman, 2013; Soda and Zaheer, 2012), however, gaps remain in our understanding. First, we lack a practice based understanding on the nature of the interaction between the formal and informal organization, its influence during the implementation of an ambidextrous strategy; and the potential strategic performance outcomes.

To examine the interaction between the formal and informal organization in the context of ambidexterity, it is first necessary to define the terms ‘formal’ and ‘informal’ organization as they relate to this research paper.

### **Defining the formal and informal organization**

The distinctive characteristics delimiting the formal and informal organization remains a matter of intellectual ambiguity. Within management and organizational theory, the formal and informal organization are recognized as distinct co-existing systems. Some scholars structurally describe the formal and informal organization as “opposing poles of a duality” (Hunter, 2016; Gulati and Puranam, 2009), suggesting the dimensions exist in a state of tension and conflict. Douglas (1988) notes that these two systems (the formal and informal) have been presented within literature as being mutually exclusive and fragmented. However, reality indicates that organizations do not solely exist in one dimension but rather within the intersection, where the formal and informal overlap (McEvily et al, 2014), and thus represent complementary engaged dimensions (Skivington and Daft, 1991). In Penny’s (1967) study of informal social relations the author proposes that the formal and informal organization should be looked upon as dimensions of organizational behavior which exist



and are defined by different “*degrees of formalization*” (p, 271). This perception of formal and informal organizational dimensions connotes blurred boundaries and grey zones where the limits of the formal and informal organization are indistinct and exist on a graduating scale. This implies that there is variability in interaction of the formal and informal organization with “a variety of combinations that affect each other in important ways” (McEvily et al, 2014: 302). For example, in Biancani, McFarland and Dahlander’s (2014) study, the authors propose another unconsidered structural dimension, the semi-formal organization. This occupies “a plane intermediate between the formal and the informal” (p. 1307) and signifies a third dimension that extends beyond the general terms of the formal and informal organization. However, Biancani et al’s (2014) study is limited in expanding our understanding of the interplay between the formal, semi-formal and informal dimensions as its empirical focus intentionally omits the informal organization. Consequently, this highlights the difficulty in separating the formal and informal in action (Morey and Luthans, 1991), for “neither the formal nor the informal can be more important than the other, as they are mutually dependent” (Morey and Luthans, 1991: 599). Recognizing that both the formal and informal are functionally co-dependent, for the purpose of analysis, this paper follows suit with Morey and Luthans (1991) in artificially separating the formal and informal, referring to them as distinct terms.

Conceptually, these dimensions have been categorized in various ways, from structural and interpersonal process views (Noble, 1999b), to hard and soft factors (Yang *et al.*, 2010), framework and process modalities (Skivington and Daft, 1991), and behavioral factors (Noble and Mokwa, 1999), each referring to nuanced components of formal and informal organizational dimensions. The formal organization refers to the established structures and processes, official rules, procedures and communication channels for operating (Blau and Scott, 1963; Penny, 1967). Designed by management, the formal organization sets what Scott (1981) calls the “blueprint for behaviors” (p. 82). The formal organization connotes authority-responsible relationships, organizational structure and design and chain of command. A behavioral perspective where roles and social systems spanning across the organization are prescribed based upon institutional rules that govern systems, procedures, structures and administrative controls (Daft and Mackintosh, 1984; Gupta, 1987), in addition to resource allocation and employee job roles. Douglas (1988) refers to structural relationships as a component of the formal organization, associating it with chain of command and authority-responsible relationships. Similarly, Diefenbach and Sillince (2011) focus on hierarchy and differentiate between its formal and informal character

– “between the official structures and rules allocating formal roles and positions at different levels and unofficial stratification among members of a social system because of conscious or unconscious social processes” (p. 1516). These designed formal structures are not a full indication of the actual routines, knowledge flows or the practicalities that operationally govern an organization. Blau and Scott (1962) contend that an examination of the informal organization and the relations it encompasses is of critical importance if we are to understand the formal organization and the processes and practices within it. Nevertheless, the informal organization has received comparatively less attention from practitioners and research scholars (Morey and Luthans, 1991).

In contemplating how an organization confronts the dual demands of exploration and exploitation activities simultaneously, the structural antecedents to ambidexterity concentrate primarily on an organization’s functional design and centers primarily on the deliberate configuration of organizational elements devised by management (Raisch and Birkinshaw, 2008). For example, structural and dynamic ambidexterity emphasize differentiating structural mechanisms to engender exploration and exploitation activities to be performed either simultaneously or sequentially. Ambidexterity theory maintains that such structural solutions create and are sustained by distinct processes, operating logics, control systems, and cultures designed and steered by senior leadership specific to the requirements for exploration and exploitation (O’Reilly and Tushman, 2004). Furthermore, exploitation is associated with “mechanistic structures, tightly coupled systems...routinization, control and bureaucracy” (He and Wong, 2004: 481), features that resemble the designed mechanistic blue print of the formal organization. However, the structural solutions to ambidexterity largely ignore the role of the informal organization, how it engages with formal organizational mechanisms and its significance.

Scholars have equated the informal organization to various elements and the proliferation of terms adds to the complexity of the concept, but studies have tended to emphasize certain aspects. Friedrichs (2015) notes that the proliferation of elements studied as part of the informal organization highlights its multidimensionality. The informal organization has been referred to in terms of unofficial social ties (Blau and Scott, 1962; Penny, 1967), group dynamics (Caldwell, 1956), informal networks of employee relationships (Krackhardt and Hanson, 1993; McEvily et al, 2014), social systems of interconnected patterns of behaviors (Fulmer and Ostroff, 2016), and peer groups whose actions are influenced by shared motives and loyalty (Biancani *et al.*, 2014; Cooley, 1956). Other

researchers have equated the informal organization to the shared norms, beliefs and values (Gulati and Puranam, 2009), behaviors, attitudes and discourse/communication systems (Diefenbach and Sillince, 2011), forms of power (non-positional), and social relations (Douglas, 1988). Researchers suggest that exploration is associated with “organic structures, loosely coupled systems, path breaking, improvisation” (He and Wong, 2004: 481), features that would appear to correspond with qualities in the informal organization.

In relation to organizational ambidexterity, contextual ambidexterity speaks of a behavioral orientation whereby individual actors determine for themselves how they divide their time between exploration and exploitation orientated activities (Gibson and Birkinshaw, 2004). Individual empowerment is deemed to be a direct result of a context intentionally crafted by an organization’s management, suggesting that contextual development is a formal strategic activity ordained by leadership. In distinguishing the informal organization from the formal McEvily et al (2014) refer to the “locus of decision rights” as a key feature. The authors explain, “whereas formal organization concentrates interaction decision rights in a limited number of roles (typically leaders, managers, or supervisors charged with directing the activities of others), in informal social networks those rights are dispersed to and shared among the actors themselves who are engaging in the interactions” (McEvily et al (2014: 305). Extending this line of argument to ambidexterity, it suggests that the contextual approach implicitly harnesses the informal organization, and that the informal organization may be a vehicle enabling the achievement of ambidexterity.

McConkie and Boss (1986) explain that everyday routine tools exist in the informal organization which enable it to create a change of climate, suggesting that “many mundane, everyday tools already exist in the organization at the informal level which can be used to create a climate of change...to change an organization in an enduring way, one must move not only the formal but the informal portions of the organization” (McConkie and Boss, 1986: 203). In emphasizing the informal organization’s capacity to bring lasting change, this stance, in the broadest sense reflects the dynamic capabilities concept for it can be seen as an organizational device with the capacity to change to an organization’s resource base (Ambrosini and Bowman, 2009). Helfat and Peteraf (2003) emphasize that to qualify as a dynamic capability it not only needs to change the resource base, but it also needs to be embedded in the firm, and ultimately be repeatable. Arguably, this conception of dynamic capabilities can be seen to reflect the informal organization. The inherent nature of the informal organization means that this feature is idiosyncratic and embedded within the organization in which it exists, and as an everyday routine tool the informal organization is

embodied in the repeatable actions, relations and interactions of an organization and its members. Furthermore, with organizations becoming increasingly complex, McConkie and Boss (1986) contend that an organization's approach to change also needs to reflect and accommodate this complexity, meaning accounting for the informal as a mechanism of change, if it is to be successful.

Whilst the co-existence of the formal and informal organization has long been recognized in sociology studies and by organization management scholars (Blau and Scott, 1963; Caldwell, 1956; Roethlisberger and Dickinson, 1939), research has begun to take a holistic approach looking at the interplay between formal and informal organizational components and the extent to which their organizational architecture complements or supplements the other to influence organizational or individual performance (Gulati and Puranam, 2009; Soda and Zaheer, 2012; Zenger, Lazzarini and Poppo, 2002). This paper departs from earlier works by going beyond the architectural elements of the formal (i.e. structure and hierarchical relations) (Chen, 2002; Gulati and Puranam, 2009) and informal organization (i.e. social network ties) (Bianciani, McFarland and Dahlander, 2014; Krackhardt and Hanson, 1993; Soda and Zaheer, 2012). Moreover, by adopting a practice perspective, the study aims to capture the performative actions and behavior, praxis (Whittington, 2002; 2006), of the informal organization and its interaction with the formal organization mapped by cultural norms, rules (Meyer and Rowen, 1977) and scripted behavior and practices (Barley and Tolbert, 1997), whilst it seeks to implement an ambidextrous strategy.

The strategy-as-practice (SAP) perspective focuses on the everyday activity of what people do and spurs an interest in the micro-activities of practitioners involved in the making and doing of strategy (Johnson, Melin and Whittington, 2003). Although this approach focuses on the role of formal strategic practices (Jarzabkowski, 2003; Whittington, 2003), it recognizes the informal as part of praxis (Macintosh, Maclean and Seidl, 2010). One can therefore argue that an SAP approach is appropriate to helping us understand the interplay between the formal and informal organization and its practices as engaged by practitioners during the strategic implementation of ambidexterity. The SAP perspective supports the exploration of patterns and actions in relation to the informal organization considering individual practices in context to the broader organizational environment.

## Interaction of the formal and informal organization

An accepted premise in literature proposes that the structures, systems and processes that constitute the formal and informal organization influence one another (Dalton, 1959; Khandwalla, 1973; Mintzberg, 1979; Rivkin and Siggelkow, 2003). Nevertheless, very few empirical studies examine how this interaction manifests in practice. McEvily, Soda and Tortoriello (2014) review of extant literature on formal organization and informal social structures highlights that studies have generally given limited attention to the interplay between these two dimensions.

Within strategy process literature, discussion defining the informal organization is limited and there is a gap in exploring the broader scope and practices of the informal organization within strategy process literature. Furthermore, there is little research that explicitly explores the influence of the informal organization, in terms of informal practices, on organizational activities or how it interacts with the formal organization in practice to influence the strategy process (Marx and Lechner, 2005). Chakravarthy et al. (2003) framework depicts the influence of organizational context, defined as management systems and the informal organization, on what the authors identify as the two core elements of the strategy process – decisions and actions. However, while the model recognizes the coexistence and complementary nature of the formal and informal organization, it does not provide further detail into the interaction between the two dimensions or the effect this interaction could have on the strategy process. In another study, Diefenbach and Sillince (2011) analysis of various organization typologies (i.e. bureaucratic/orthodox, professional, representative democratic, hybrid and network), and the nature of the formal and informal within these arrangements provides a nuanced perspective, emphasizing what McEvily et al (2014) refer to as a reciprocal influence. Diefenbach and Sillince (2011) propose that formal and informal hierarchical structures and processes exist, and the degree of influence one has on the other varies depending on the type of organization and the nature of the relationship between them. The authors conclude that the relationship between formal and informal elements is not static or universally consistent but fluid, existing across a graduating spectrum; “it seems that *whenever formal hierarchy decreases, informal hierarchy increases...* constitutes a continuum of dynamic relationships of formal and informal hierarchy” (Diefenbach and Sillince, 2011: 1530. Italics copied from original text). Although Diefenbach and Sillince (2011) focus primarily of the relations between formal and informal hierarchy their perspective of the dynamic relationship between formal and informal organizational

elements corresponds with the definitional view of the formal and informal as graduating degrees rather than static organizational states.

Thus, in exploring the dynamic between the formal and informal, we can deepen our understanding of the complex internal constitution of organizations and the realities of enacted practices that influence strategic outcomes.

### **Primacy of the formal organization and its interaction with the informal organization**

The assumption traditionally held in the literature posits that the formal organization influences and shapes the form of the informal organization (Dalton, 1959). Thus, changes in the formal organization also cause changes in the informal organization. This resonates with McEvily et al's (2014) research categorization of the formal organization as contouring and determining the boundaries of the informal. Utilizing Krackhardt's graph theoretical dimensions of the informal structure, Hunter (2016) analyzes relations between formal structure (i.e. span-of-control and levels of hierarchy) and informal networks (i.e. trust networks and advice networks respectively). Hunter (2016) concludes that hierarchal position in the formal structure influences the formation of ties between individuals within the informal network. Likewise, King and Nembhard (2017) study on the interplay of the formal and informal organization shares Diefenbach and Sillince (2011) hierarchical interpretation of both dimensions. Analyzing 12 community health centers, the study looks at how the network structure and group interactions of members formally positioned in the middle of the hierarchy alters when they receive an expansion of power as a result of change in a formal role. King and Nembhard (2017) find expansion of power for those hierarchically positioned in the middle has a mixed effect on the informal organization. On the one hand the formal organization has a positive effect on the informal by reducing relational inertia – "holding onto existing relations and relationships, often undermines formal organizational change efforts" (King and Nembhard, 2017: 1252). However, formal role-power expansion also has a negative effect by inducing combative informal interactions through the escalation of status conflicts.

Burgelman's (1983) model of strategic behavior highlights management's ability to manipulate the structural context as a way of controlling behavior and keeping it in line with its strategic intentions and identity. This is reflective of the formal organization used as a mechanism by management to influence Burgelman's concept of the strategic context, which can be said to resemble the informal organization. Nickerson and Zenger (2002:552) speak of "pegs" provided by the formal organization around which the informal organization is

organized and augmented, however, they do not specify what these “pegs” are or how they, as a mechanism, come to augment the informal. The authors contend that the informal organization is contingent on the rules, and cultural norms of the formal organization and so shapes and determines how the characteristics of the informal organization are perceived, for “formal structure is therefore a mechanism through which the informal organization can be shaped” (Nickerson and Zenger, 2002: 551). Under this general premise the informal organization may be considered as influenced by the formal organization, suggesting that the source of change emerges from the formal organization. On this Gulati and Puranam (2009) explain that the formal structural mechanisms of grouping and linking (Nadler and Tushman, 1997) influence the shape of the informal organization by specifying vertical and horizontal communications and interactions between individuals. Arguably, these communication channels are task orientated and revolve first and foremost around the roles and responsibilities of those involved. This differs from the informal social structures and relational channels attended to the role of the informal organization. Schein’s (1965) view denotes the informal to be an output of the formal stating “(informal) relationships *tend to arise* in all formal organizations” (p.9), that “formal organizations *tend to breed* informal organizations within them” (p.27. Cited in Penny, 1967: 271). In reference to the stream of influence this perspective gives primacy to the formal organization over the informal as shaping and directing the latter.

### **Primacy of the informal organization and its interaction with the formal organization**

An alternative proposition observes and emphasizes the informal organization (McEvily et al, 2014). It also suggests that informal networks emerge and act in response to shortcomings of the formal organization in addressing a specific issue (Nickerson and Zenger, 2002; Simon, 1957), thereby implying that the informal network can problem solve and accomplish results unachievable by the formal, and as an organizational mechanism can enhance member performance. Chakravarthy and White (2002) theorize that the informal organization is an important lever able to engender change in the organization but note that there is a gap in our understanding of its role. In this regard, informal behaviors exhibited by actors are aligned with Burgelman’s (1983) concept of autonomous strategic behavior which sits outside the organization’s structural context and has the capacity to “escape the effects of the structural context” (p. 67).

Friedrichs (2015) also contends that “the informal organization not only determines the functionality of formal organizational elements but also affects psychological and

personal aspects of employees... On the other hand, employees are urged to re-define formal prescriptions and to improvise in unprecedented situations when the formal organization gives no or unsatisfactory answers, and to provide innovative behavior. Therefore, the informal organization is an inevitable firm feature” (p. 3). Similarly, Aalbers, Dolfsma and Koppius (2004) suggest that the informal organization has the potential to bypass, and even undermine, the communication structure within the formal organization. Although they make specific reference to communication structure and the informal organization’s influence over the formal in this regard, they lay ground to the prospect that the informal organization has the potential to bypass other organizational structures beyond communication (ibid.). Krackhardt and Hanson (2000) advance this argument suggesting that in bypassing formal organizational elements, the informal organization operates as an autonomous mechanism that can enhance individual and firm performance. The authors comments that “designed to facilitate standard modes of production, the formal organization is set up to handle easily anticipated problems. But when unexpected problems arise, the informal organization kicks in. Its complex webs of social ties form every time colleagues communicate and solidify over time into surprisingly stable networks. Highly adaptive, informal networks move diagonally and elliptically, skipping entire functions to get work done” (Krackhardt and Hanson, 2000: 104). In this regard, the informal organization provides a mechanism for flexibility, adaptability and experimentation in a manner unavailable through the strict structures and procedures directed by the formal organization.

An example of the skipping, bypassing behavior purported by Krackhardt and Hanson (2000) has been studied in communication and psychological behavior literature on employee dissent under the term: circumvention. Kassing (2007) explains that “circumvention entails expressing one’s dissent to someone higher in the chain of command than one’s immediate superior” (p. 57), classifying it as an upward dissent communication move exercised by employees to share concerns about their supervisor’s performance capabilities. Viewing circumvention in the context of dissenting behavior, Garner (2015) argues that the status quo is challenged by the dissenter who perceives their own actions of circumvention to be in opposition to managerial expectations. This behavior contradicts the formal expected behaviors promoted within an organization which Warren (2003) refers to as formal norms (e.g. rules, procedures, codes of conduct); and is congruent with his categorization of informal norms- actual exhibited or repeated behavior. Therefore, circumvention has been viewed as illustrative, if not exemplary, behavior featured in the informal organization.



**Organizational design and architecture perspective:**

<b>(A) Theoretical perspective</b>	Network perspective; individual performance
<b>Defining formal organization</b>	Formal workflow, structures, processes, roles
<b>Defining informal organization</b>	Pattern of advice and information relations between actors
<b>Modes of interaction (formal and informal organization)</b>	<p><i>Overlapping of formal and informal</i></p> <ul style="list-style-type: none"> <li>- Degree to which consistency exists between the network architecture of the formal and informal organization. Ties across the formal and informal network may be replicated</li> </ul> <p><i>No-overlapping of formal and informal</i></p> <ul style="list-style-type: none"> <li>- Degree to which inconsistencies exist between the network architecture of the formal and informal organization. Ties across the formal and informal network are different</li> </ul>
<b>Studies</b>	Soda and Zaheer (2012); Scott and Davis (2006); Miller (1992); Nadler et al (1997)
<b>(B) Theoretical perspective</b>	Reorganization; organizational ambidexterity
<b>Defining formal organization</b>	Normative social systems designed by managers and can be changed rapidly
<b>Defining informal organization</b>	Emerging pattern of internal social interactions within an organization (i.e. advice, gossip, informal conversations)
<b>Modes of interaction (formal and informal organization)</b>	<p><i>Compensatory</i></p> <ul style="list-style-type: none"> <li>- Inconsistency exists between the formal and informal organization with one element moving in a different direction to make up for weaknesses in the other may be replicated</li> </ul> <p><i>Supplementary</i></p> <ul style="list-style-type: none"> <li>- Consistency exists between formal and informal organization. Both elements move in the same direction and emphasize the same employee behaviors</li> </ul>
<b>Studies</b>	Gulati and Puranam (2009); Hannan (2003); Nickerson and Zenger (2002); Siggelkow (2002)

Table 6: Conceptualizing interaction between formal and informal organization  
– Organizational design perspective

## Behavioral

<b>(A) Theoretical perspective</b>	Dissent strategies
<b>Defining formal organization</b>	Governing ideas, procedures or policies assumed and followed by the majority
<b>Defining informal organization</b>	Individuals or a group in opposition to the governing ideas and policies
<b>Modes of interaction (formal and informal organization)</b>	<i>Circumvention</i> - Upward communication move where an employee expresses dissatisfaction to a superior above their immediate supervisor
<b>Studies</b>	Kassing (2000); (2002); (2007); (2008); (2009); (2011)
<b>(B) Theoretical perspective</b>	Proactive behavior
<b>Defining formal organization</b>	Behavior conforming to the current way of working and does not attempt to engage in or instigate change activity
<b>Defining informal organization</b>	An individual's way of behaving at work, shaped by individual differences and situational forces
<b>Modes of interaction (formal and informal organization)</b>	<i>Personal Initiative / Taking charge / Employee voice / Individual innovation / positive deviance</i> - Self-directed and future-orientated action that aims to bring about change in a work related situation (e.g. introducing new work methods, influencing organizational strategy)
<b>Studies</b>	Bateman and Crant (1993); Bindl and Parker (2010); Fay and Frese (2001); Griffin et al (2007); Morrison and Phelps (1999); Parker, Bindl, Strauss (2010); Scott and Bruce (1994); Spreitzer and Sonenshein (2004)

Table 7: Conceptualizing interaction between formal and informal organization  
– Behavioral perspective

### Interactive effect of the formal and informal organization on performative outcomes

Strategic management studies examining the interplay between the formal and informal organization draw upon organizational design and architecture literatures. Underpinning these conceptualizations is the concept of consistency and the degree of organizational fit between elements of the formal and informal organization (Gulati and Puranam, 2009). The dynamic interactions under the scope of organization design and architecture are presented as dual dimensions, whereby the interaction is viewed in opposite directions (i.e. overlapping or non-overlapping). In characterizing the informal organization's

influence upon a firm's innovativeness, Friedrichs (2015) emphasizes the concept of consistency and inconsistency between the formal and informal organization. Studies highlight the informal organization as a complementary and supportive function to formal structures (Gulati and Puranam, 2009; Soda and Zaheer, 2012), indicating a united strategic orientation which serves to meet the organization's strategic goals. In relation to ambidexterity, this line of argument would suggest that the informal organization has the capacity to facilitate and promote explorative activities given the assumption that the formal organization prescribes how existing activities are to be executed (exploitation activities). Kang et al (2017) assert that "an informal organization, defined as organizational routines supporting a formal organizational structure, cannot be modified as quickly as a formal organization structure" (p. 1357). However, in exploring the role of the formal and informal organization in relation to ambidexterity, Kang et al (2017) find that the informal organization provides for the temporal achievement of ambidexterity as the formal organization vacillates from exploration to exploitation because of its inertial lagged response to change, it possesses both exploration and exploitation characteristics as it undergoes the vacillating transition. I would therefore argue that extending this line of argumentation can help us broaden our understanding of the nature and influence of the informal organization on strategic activity.

On the other hand, studies also demonstrate that inconsistency between the formal and informal can hold value and result in ambidextrous outcomes and increase individual performance (Gulati and Puranam, 2009; Soda and Zaheer, 2012). Notably, Schilling and Fang (2013) recognize that the informal organization also has the capacity to negatively affect an organization's functioning, particularly when individuals engage in activities motivated by self-interest and agency. Table 6 summarizes the general conceptualizations of the organizational design perspective and the different terminology that has been used to describe the dynamic modes of interaction between the formal and informal organization, emphasizing different nuances and characteristics.

The behavioral perspective draws on factors different to the organizational design stance and provides an alternative understanding of the modes of interaction between the formal and informal organization and its performative outcomes. Organizational behavior literature on dissent and proactivity gives different insights on behavioral modes of interaction between the formal and informal; expanding our understanding of the interaction and its manifestation in practice. Table 7 summarizes general conceptualizations of the

behavioral perspective on the interaction between the formal and informal organization. Literature on dissent and proactive behavior highlight practices and behaviors active in the informal organization that interact with and even seek to change features of the formal organization. Organizational dissent describes when one or more employees, for the good of the organization or for personal gain, explicitly disagree with current practice or policies (Garner, 2012; Kassing, 2011). When considered as a beneficial form of deviant behavior (Warren, 2003) the dissenter is one who deviates from organizational rules, procedures and workgroup norms, challenging the status quo, which they perceive to counter managerial expectations (Garner, 2015). Studies have shown that dissent can enable creative problem solving and individual creativity (De Dreu and West, 2001; Shahinpoor and Matt, 2007).

Similarly, the broad and diverse literature on proactive behavior and initiative (Griffin, Neal and Parker, 2007; Morrison, 2011) has parallels with this study. Proactive behavior has been defined as “taking initiative in improving current circumstances or creating new ones; it involves challenging the status quo rather than passively adapting to present conditions” (Crant, 2000: 436); and has been linked conceptually and empirically to superior performance (Griffin et al., 2007). At the individual level studies found proactivity can lead to individuals performing more effectively in their jobs (Ashford and Black, 1996; Morrison, 1993), and at an organizational level it was found to predict positive financial performance (Aragón-Correa *et al.*, 2008) and engender greater engagement in organizational activities (Aragón-Correa, 1998). Proactive behavior draws similarities to an underdeveloped area in organizational studies - positive deviance (Herington and van de Fliert, 2017). Spreitzer and Sonenshein (2004) define positive deviance as “intentional behaviors that significantly depart from the norms of a referent group in honorable ways” (p. 841), making it distinct from negative deviant behaviors that threaten an organization and its members. However, Vadera, Pratt and Mishra (2013) argue that constructs such as proactive behavior and positive deviance fall under the ‘umbrella term’ of constructive deviance and should to be examined integratively.

Furthermore, research findings repeatedly show that organizational cultures and climates can foster or impede dissent and proactive behavior (Kassing, 2008; 2011).

### **Organizational actors and their interaction with the formal and informal organization**

The formal and informal organization is composed of actors from multiple levels of the organization’s hierarchy. The interaction between the formal and informal organization is

dependent upon the actors who engage with these organizational elements and are the ones who enact practices that underpin the interaction, affecting the organization's functionality and strategic change activity. Current literature in the field of strategy-as-practice, dynamic capabilities and ambidexterity primarily focus theoretically and empirically on the top management team (TMT) (O'Reilly and Tushman, 2011), and to a lesser extent the role of middle-level managerial actors (Gupta and Govindarajan, 1984; Heracleous, 2000). However, empirical research has mostly neglected the role and potential influence of low-level and non-managerial individuals and the practices they engage in when embedding strategic activity (Yang et al., 2010).

Diefenbach and Sillince (2011) highlight the significance of organizational actors claiming that “much of the way in which the formal and the informal interact depends on the actual people involved, how they perceive and interpret the social situation they are in, how they act, how they continue to reflect on their social practices – and how this feeds back into the principles and mechanisms of the social system and contributes to its continuation, change or discontinuation” (p. 1533). The knowledge and experience employees possess to perform their routine tasks and fulfil official job responsibilities also simultaneously enables them to find ways around official channels. Diefenbach and Sillince (2011) explain “those who know the rules also know how to bend or bypass them, whom to approach if they want to get things done a certain way or whom and what to avoid if they do not want to do certain things” (p. 1521). It may not turn out explicitly positive for the individuals in the firm to deviate from formal prescriptions. They may do so with good intentions, but formal appreciation or sanctioning mechanisms may not honor the outcomes or may punish the deviations given that employees and managers “are held accountable to the map, not the road conditions” (Brown and Duguid, 1991: 42). This has implications for the study of informality in firms, and our understanding of how actors engage with formal and informal organizational elements and the practices enacted by organizational actors.

This paper contends that organizational practices that influence strategic activity are not constrained to the formal organization or formal strategic practices but can reside also within the informal organization. Figure 4 illustrates the framework of concepts pertinent to this study. For the informal relates to the actual enacted habits and behaviors of actors and these play an important role in determining an organization's operational performance (Nickerson and Zenger, 2002). By analyzing the organization through two dimensions – the formal and informal - this paper explicitly highlights the significance of the informal organization and its interaction with the formal organization, as a component that influences

strategic activity, ambidexterity, and is distinct yet related to the formal organization. Furthermore, it expands the conceptualization of organizational actors beyond the top management team to include actors across the organizational hierarchy in managerial and non-managerial levels.

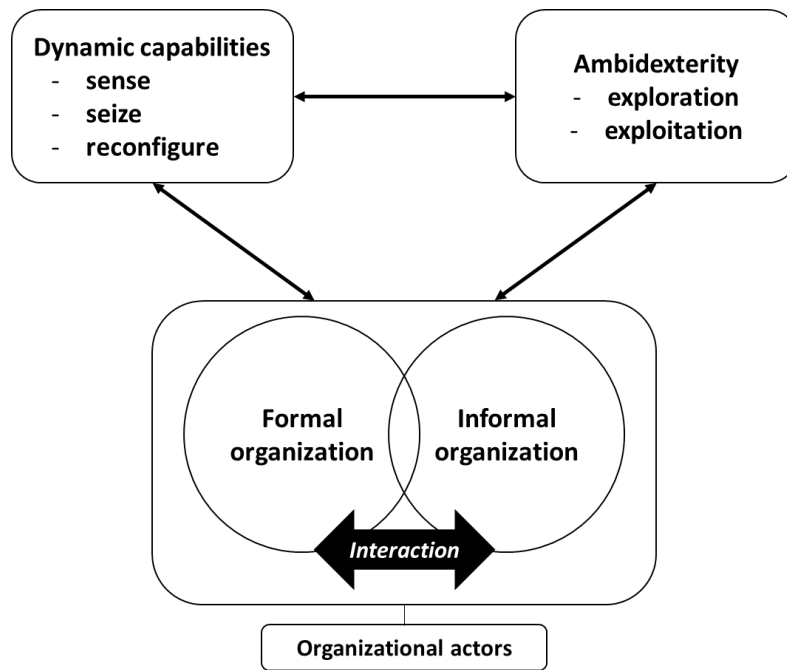


Figure 4: Framework of concepts

## METHOD

### Research Design

This study's grounded (Strauss, 1987), single-case approach (Yin, 2014) follows the tradition of rich in-depth case studies on the inner context of organizations in relation to their organizational structures, processes and social behaviors. Exemplar cases include Selznick's (1949) seminal study of the Tennessee Valley Authority (TVA) and the limitations of the formal organization and its structures; Pettigrew's (1973) study on UK retailers Brian Michaels and changes in the distribution of power and status over time and its effect on decision-making; and Harrell, O'Reilly and Tushman's (2007) study of IBM's transformation to become a

leading global information-technology solutions service provider and its strategy execution.

This research approach allows for the study of complex phenomena in a real-world context, helping to capture the interaction between the formal and informal organization during strategy implementation as it transpires within an organization transitioning towards ambidexterity. Further, it aims to provide an empirically grounded theory that contributes to understanding practice in the informal organization, as employed by practitioners, and its effect on the dual pursuit and management of exploration and exploitation. I focus on the everyday activities of organizing and recurring patterns of actions at the NASA Johnson Space Center (JSC) in Houston, Texas (USA).

The initial intention of the study was to develop an empirically grounded theory of how an organization such as JSC pursued exploitation activities whilst simultaneously maintaining its exploration capabilities. While conducting this investigation the significance of the informal organization and certain practices enacted by it and within it during its strategy implementation process emerged and became increasingly apparent.

To understand ongoing practices in the informal organization, I adopted an ethnographic approach (Van Maanen, 1988). In so doing, this ethnographic approach allows for the significance of the informal to be recognized beyond formal systems more so than current knowledge permits, and is in a vein similar to Morey and Luthans' (1991) ethnographic study of a bureaucratic organization and its informal organization. Furthermore, the ethnographic approach aims to address the call by Bettis *et al.* (2015) for more qualitative empirical studies to aid in generating new insights within the field of strategic management.

## **Data Collection**

Data was drawn from diverse sources including interview transcripts, field-observations of meetings and corporate events, internal documents and secondary sources. In total 82 semi-structured interviews were conducted with 57 informants from different departments and various levels of the organizational hierarchy (see table 8). In the field data collection occurred in four phases between August 2014 and

September 2015<sup>26</sup>. Interviews lasted between one to three hours and all but twelve of them were recorded with informants' permission and were transcribed. For the interviews not recorded hand written notes were made as a record of the interview where the informant's consent was provided. An interview protocol was employed initially, containing standardized questions about informants' employment history at JSC and their perceptions of the strategic change plan and its implementation. Questions were then customized depending on hierarchical level, organization division, employment type (i.e. contractor or permanent staff), and employment tenure. Subsequent interviews became progressively more structured as themes emerged from the data. Follow up interviews were conducted with several informants and served to inform or refine emerging themes that arose from earlier interviews. In certain instances, they allowed discussions to be expanded, covering new, unexplored topics not previously touched upon. For example, it emerged that innovation was defined not at an organizational level but at the division, group and even individual level. This has implications on the formal and informal activities engaged to implement the organization's strategic goal. New themes such as these were deemed worthy of exploring as it highlighted complex unexpected issues in the implementation of ambidexterity that transcended across organizational levels and formal and informal actions.

Field notes based on approximately 64 days of onsite observation were also gathered. I observed team meetings, progress updates and ongoing activities; Center wide communication events on JSC's strategic plan and its implementation; poster sessions communicating in-house innovation projects; informal meetings between individuals and groups in social settings, and employee interactions and social behaviors. Informants were aware of my presence and topic of investigation and were notified that participation in the research was voluntary. I tried to maintain an unobtrusive presence throughout to ensure that observations reflected the usual behaviors of the participants. This allowed for informal practices to be observed and captured and later confirmed and elaborated on in interviews. I noted observations,

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<sup>26</sup> Refer to the methodology section in chapter one of this thesis for details on the four phases of the research data collection process.



reflections, other field references and emerging theoretical concepts in a field journal and employed this information in subsequent analysis.

<b>Informants</b>	<b>Number of interviews</b>
Executive officers	1
Directors	2
Assistance directors	2
Division manager	1
Division chiefs	6
Division deputy managers	4
Deputy manager	1
Branch chiefs	6
Managers	2
Project manager	1
Team leads	7
Senior technical specialists	2
Senior office manager	3
Senior analyst	2
Technical Specialist	1
Office manager	7
Officer	4
Contractor	14
Intern	2
Former Employees	10
External industry experts	4
	82

Table 8: Interview Data

Secondary data was also gathered from public sources (i.e. press releases, case studies focused on NASA/JSC, media articles, published books, industry reports, news videos and relevant documentaries), as well as internal organizational documents for analysis. I also snapped approximately 74 photographs as a way of documenting aspects of JSC’s physical environment. Organizational members were not captured in photographs, unless they granted permission for me to do so. Interview transcripts, observational data, and secondary data sources were triangulated to ensure reliability of interpretation and the conceptual development of data.

## **Data Analysis**

Interviews, observational field notes and other sources of data were analyzed using inductive qualitative techniques (Strauss and Corbin, 1990). The first stage of the analysis consisted of multiple, iterative readings of interview transcripts and observational field notes to identify themes and patterns in informant accounts and events. Following the analysis of interviews and observational data from research phases one and two I identified within the data particular ‘episodes’ – an event or specific activity (Chuang, Wang and Judge, 2015) - of informal practice relating to the ambidextrous strategy and its implementation which was either revealed by informants as they explained their experiences or was directly observed by me as the researcher and captured in my field notes. From this I detected emerging patterns of behaviors being exhibited by individuals and groups across different levels of the organization – individual, middle managers and senior management, which did not fall within the formal organization’s prescribed procedures. These behaviors appeared to challenge the formal blue-print, going against formal procedures and the organization’s prevailing context. For example, an individual bypassing set steps within an official approval process; or a group of managers overcoming formal structural constraints to encourage greater communication and innovation in lower level employees. During this stage line-by-line open coding, using NVivo qualitative data analysis software, was conducted resulting in a number of codes about the dimensions of the informal behavior, its interactions with formal organizational elements and the contextual conditions shaping it. At each of the four phases of the investigation I would continually reassess, question and modify codes so that they accurately captured the essential elements of the data and were analytically relevant (Coffey and Atkinson, 1996). Research phases three and four provided the opportunity for the researcher to return to the field and intentionally look for and gather data of other episodes of this informal practice in action. This data was fed back into the analysis and helped to generate initial theoretical ideas.

These first-order codes were grouped into clusters forming subcategories and broader categories. Memos and brief notes of analytical insights (Strauss, 1987) were generated whilst analyzing the various data sources throughout the course of the project and were continuously matched and compared to develop and refine themes and theoretical interpretations of the data (McCracken, 1988) and their interrelationships (Gioia, Corley and Hamilton, 2012). Through a process of

constantly comparing first-order codes within themes second order codes were developed in line with Gioia et al. (2012) second order labeling approach. In reaching theoretical saturation (Glaser and Strauss, 1967) the themes and theoretical interpretations developed formed the basis of an underlying framework integrating the concepts for the practice of circumventing. Figure 5 summarizes the emergent structure of the data. Table 9 depicts the theoretical categories of the study – themes and illustrative quotes from informants.

### **The Case: The NASA Johnson Space Center (JSC)**

The NASA Johnson Space Center (JSC) is one of 10 publicly funded field centers with a core focus on the development of human performance science and technological innovation for the enablement of deep space exploration. JSC functions as a decentralized unit but its Center operations and processes are governed by its national legislature and regulations. As a consequence of declining budget allocations over time JSC has to learn to operate under the constraints of scarce resources and combine explorative and exploitative activities simultaneously. Recent changes in the space industry, including the commercialization of space and the emergence of credible competition from private investors and from other sovereign nations combined with the end of one of its major human spaceflight programs in 2011, have permanently changed the dynamics in which JSC must operate and raises difficult questions over its future.

In 2012 a new executive director was appointed at JSC who established a new strategic change plan, 'Vision 2.0', intended to reinvent the organization and bring it into alignment with its rapidly changing environment and decreasing budgets by being 'lean, agile, responsive and adaptive to change' (Internal JSC document, 2014a) whilst also pursuing its vision to advance human space exploration and emphasis on the importance of innovation and the solicitation of new ideas. The organization set about implementing ways to be sustainable, affordable and efficient whilst simultaneously encouraging further innovation in ideas and actions; in essence, a strategy akin to organizational ambidexterity. Change efforts of this kind often rely on alterations occurring in the structure, reporting systems and processes of the formal organization, although design efforts may also be made to influence social groupings and employee relationships within the informal organization (Biancani et al., 2014). The

implementation of a new strategy is critical to JSC if it is to continue to remain relevant and achieve organizational ambidexterity.

JSC is considered as a unique and revelatory case (Eisenhardt and Graebner, 2007) for an initial focus on understanding the shift towards an integration of explorative and exploitative behaviors, and subsequently the significance of the informal organization and its interaction with formal organizational elements. As a single case, JSC provides an opportunity for unusual research access (Yin, 2014) and is particularly well suited to study the informal organization and how it can impact strategy implementation. As a complex government funded body the organization's internal environment and its mission is shaped by the nation's federal legislation and the political agenda of the incumbent government. Therefore, being government funded one would expect the formal organization to be the primary emphasis at JSC. Its ability to implement change is bounded by bureaucracy and therefore its informal organization acts as a mechanism with the potential to execute positive improvements and change organizational characteristics. JSC has a strong history in human space flight and its legacy permeates and conditions the organization's structures, processes and culture even today. Because the organization is in the process of implementing its strategic change program in an effort to become ambidextrous in operating exploration and exploitation activities simultaneously, it provides a valuable opportunity to witness the strategy implementation process as it occurs within a complex organization and observe the formal and informal mechanisms and how they are engaged.

## **FINDINGS AND ANALYSIS**

The findings show how the informal organization, through the practice of circumventing, can sense and identify inhibitors in elements of the formal organization hampering the transition to ambidextrous operations; and how this practice is reflective of a dynamic capability and can provide a means of promoting exploration and exploitation during the implementation of an ambidextrous strategy. The paper finds two dimensions of the informal organization - (1) strategic focus (sensing), (2) divergent proactive behavior (seizing) - engages with the formal dimension, the prevailing organizational context, to produce the enacted practice and

that this interaction culminates in mixed outcomes. While analytically speaking these dimensions can be seen as independent, their combined configuration engenders interactions between formal and informal organizational elements that produce a distinctive effect on the case organization's strategy implementation. The study also examines how two contextual mechanisms moderate and influence resulting outcomes, including the reconfiguration of resources, as a consequence of the practice of circumventing: (1) positional formal authority, and (2) degree of informal status. The following firstly discusses the three core dimensions central to the practice of circumventing and the interrelations between the formal and informal organizational elements involved. It then explains how formal positional authority and informal status have a combined influence that can lead to differential outcomes for strategy implementation of exploration and exploitation activities.

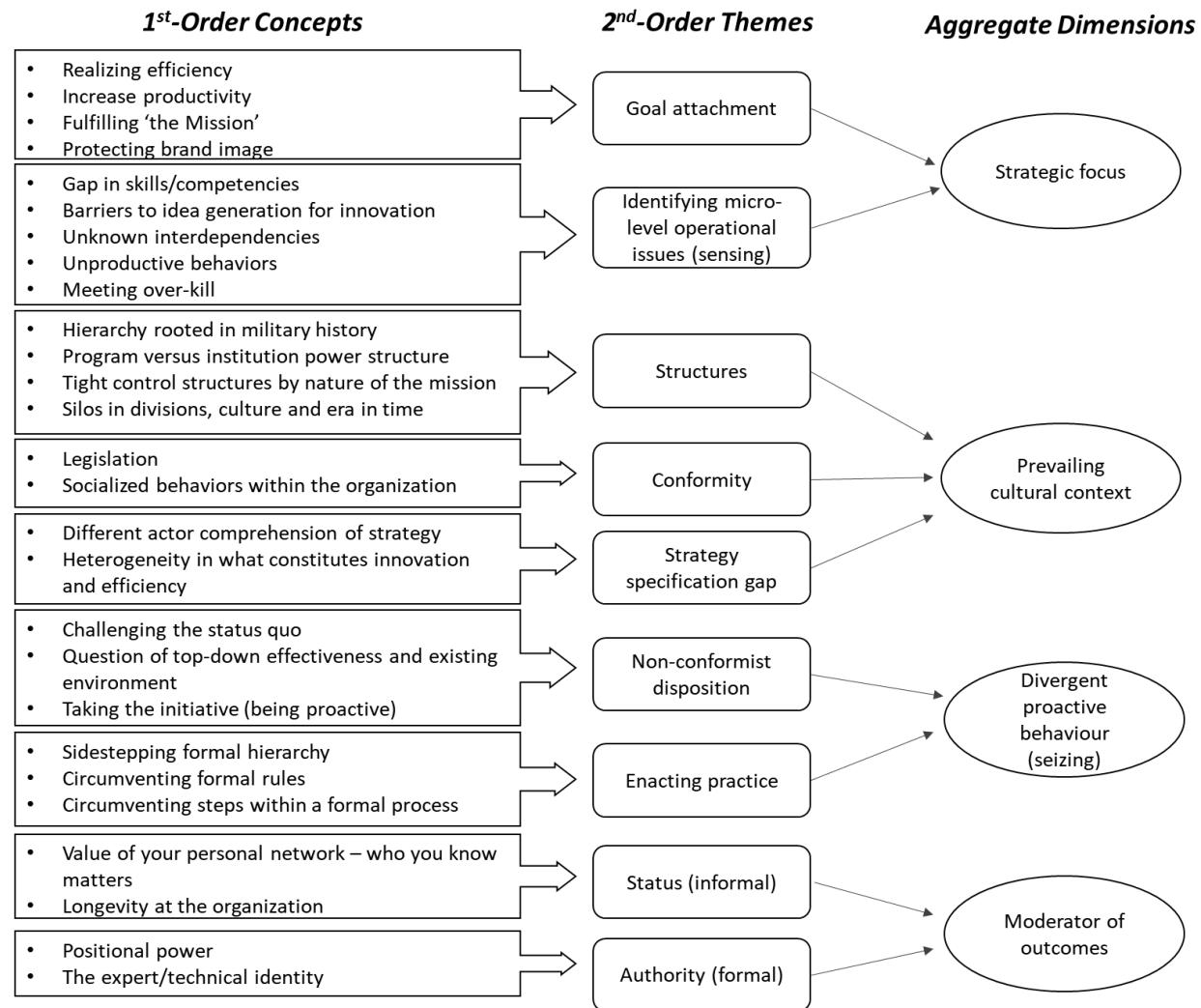


Figure 5: Data Structure

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**Dimensions, themes and quotations**

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<b>Aggregate dimensions</b>	<b>Second-order theme</b>	<b>Illustrative quotes</b>
Strategic focus	Goal attachment	<p>"We're alpha types here. So just give us something. Give us a mission and let us go do it" (Office manager)</p> <p>"Our job is to execute the mission that we're given. So because of our heritage there is a perception that our only concern is to execute technically what you are given to do" (Division Chief)</p> <p>"We're very mission oriented...because when you work here and live here you just get sucked into the bubble" (Senior office manager)</p> <p>"They [certain divisions] are very mission driven. They know what to do and how to make things work ..." (Office manager)</p>
	Identifying micro-operational issues	<p>"One of the things the [division director] realized was that we had a whole generation of engineers that had never cut their teeth on a real large hardware project. That had never built something from first principles" (Senior technical specialist).</p> <p>"It's not enough to talk and think we understand [the relationship to other internal organizations]. We're going to lay this out and draw a set of interface diagrams for all of this...this is done to a degree quite frequently, but what I don't feel like is not done enough is diagram out how systems work...technical and people processes. The interface of all of that" (Technical specialist)</p> <p>"There's a tension between those who are there and just waiting versus those who are proactive" (Workshop participant)</p> <p>"As I moved over and was responsible for the directorate on Apollo, it became pretty obvious to me that one of the areas of key weakness in the whole program was that nobody really knew what the other guy was doing in the program. There was an awful lot of specialist area, and the program office was trying to keep them coordinated from a program office point of view –" (Archives, 1970)</p>
Prevailing organizational context	Structures	<p>"Now it's a very clear distinction [speaking of technical and business divisions] and right now in fact it's clearer than it should be. Because the truth is we the mission should, and are starting to make much better use of the [business] resources. But for a long time it was, we know what we're doing. We can do best for us. So we will do it ourselves" (Technical specialist)</p> <p>"All the orgs are structured but it's the level of structure that differs" (Workshop participant)</p> <p>"First I was like, okay, who's my next chain in command? Oh, here's your Lead. Who's his chain? There's your Chief. Okay" (Team Lead)</p> <p>"It's very, 'you have to run it up your chain, you have to go to the change board, you have to go to the pre-change board, post-pre change board" (Team Lead)</p> <p>"Technical organizations are seen to have an elevated position over business functions, with the latter being seen as second-class" (Workshop participant)</p> <p>"I think to, that there is a certain territoriality on the part of certain managers and directors. And sometimes that's about funding and then sometimes that's about ego and the org" (Office Manager)</p> <p>"It's about budget!" (Officer)</p>

Prevailing organizational context	Conformity	<p>"I mean they [speaking of a particular division] have institutional paralysis worse than anybody else onsite" (Technical specialist)</p> <p>"It's very much 'you don't know your place', 'you need to make sure you're talking to me about it'. And that's a lot of the culture here" (Team Lead)</p> <p>"Well this is the hole, I think you have the right finger size to plug that hole up" (Contractor)</p> <p>"In some areas, conformity is celebrated" (Workshop participant)</p> <p>"Because we're a government agency we can't do marketing to the public" (Branch Chief)</p>
	Strategy specification gap	<p>"I think it's different for each one of-- like I said that I-- and a lot of it, for me, is how you were brought up in the business world, you know" (Branch Chief)</p> <p>"One of the points that we tried to make with those events was that an innovation can be something that alters the state of the art, state of the technology, whatever it is, but it can also be a small shift that leads to doing something better. We very expressly made the points with people who are coming to share their innovations in that Innovation Day activity, was that we didn't want just all technical, that we expected the legal office to be bringing forward some, or we expected the Chief Financial Officer's office to bring forward innovations, that this was for everybody. It wasn't just the technical, because we should all be seeking to do new and better things in every aspect of what we do" (Deputy Division Manager)</p> <p>"an innovation is not just the technical shuttle thing, but it could be a processor..." (Branch Chief)</p> <p>" So it [innovation and efficiency] maybe -- change maybe the for them just a change in style, or change or something that not necessarily for efficiency purposes, but the new idea. But from a resources standpoint, budgetary standpoint, it's really a process that makes you more efficient" (Branch Chief)</p> <p>"innovative in the resources budget world, is more process oriented. Meaning doing things better more efficient. From a technical standpoint, it could be just a fresh new idea" (Branch Chief)</p>
Divergent proactive behavior	Non conformist disposition	<p>"That's another thing at JSC that also happens, is you bring forth an idea, one person goes this is s*** and it just disappears.... So we did stuff about new ideas. How new ideas are vetted, and it shouldn't be primarily though Chiefs" (Team Lead)</p> <p>"I'm thinking...okay, how at the Center can an idea be vetted and given control outside of their major management chain?" (Team Lead)</p> <p>"It goes back to not conforming but being different. It creates lots of uncertainty ..." (Workshop participant)</p> <p>"...It can't always come from the top-down even though that's some peoples warm and fuzzy, 'somebody tell me what to do'. But taking control of your own actions. And really, cos if I am going to have to live with it I don't want somebody who's going to be retiring in 2 years figuring this out for me. It's gonna be me. And I know that's a little bit of an offensive attitude to have here. But it is, it's like, you're not going to be living with this in the next 10 years it's going to be me. It should be me making that decision." (Team Lead)</p> <p>"There is definitely a fear of the unknown here. And that for me is one of the most frustrating things when I encounter it. Because the unknown is at the heart of what we do, you know, and so to a degree if you're afraid of the unknown if you're unwilling to confront the unknown, what are you doing working here? And that's an aggressive statement but that's where I am in terms of frustration because I really do think there's no place for that" (Technical Specialist)</p>



Divergent proactive behavior	Enacting practice	<p>"...I also enacted something where people talk directly to the Director and not their Chief. It's sort of like a skip level meeting...Which is something that a lot of [divisions] won't do because they're very hierarchical". (Team Lead)</p> <p>"I'd gotten more traction you know doing my own thing and going to a random class then going through the traditional chain"(Team Lead)</p> <p>"We even have something called, and this is a horrible name, a [named initiative]. So, you get four or five people from the directorate and they just walk around with our director. And, and whatever is on their mind she'll ask them questions, they'll ask her questions... when [named initiative] were first introduced challenged the formal way of doing things... The joke is when managers say they have an "open door" policy is easy to say when you have an empty office due to too many meetings". (Team Lead)</p>
Moderator of outcomes	Status (informal)	<p>"And it is about who you know. And a lot of people use that to their advantage" (Team Lead)</p> <p>"It's this very like inbred sort of...we knew each other for 20 years. And then the younger generation is, well I worked with them in that one class. Or I met them in that one meeting and they don't have that long history" (Team Lead)</p> <p>"And the longer people stay here, because the average age here is I think in the 40's. 40 or 45. So when somebody's 20's, 30, you're sort of looked upon like some zygote whose going to meetings with you even though you have just as much education, you have just as much experience but for some reason they feel like you haven't fully cooked yet" (Team Lead)</p>
	Authority (formal)	<p>"You shouldn't judge my idea no better, no worse just for the fact that I haven't worked here for 32 years" (Team lead)</p> <p>"There are some of those things to do from a top down perspective ; to say no you're not all going to buy these things separately. This is the one best solution you're all going to use it" (Technical specialist)</p> <p>"There's an authority and respect thing here" (Contractor)</p> <p>"But still, the culture is very much driven by technical experts" (Office manager)</p> <p>"One of my mentors happened to be a [talks of a particular role at a senior level in the organization], who are treated like little demi-gods really" (Team Lead)</p> <p>"National politics has power over JSC and determines its mission" (Division Chief)</p>

Table 9: Data Table

## **Strategic Focus**

With the practice of circumventing, data shows that the informal organization is capable of having a strategic focus that is in alignment with the formal goals of the organization. The strategic focus of an individual or amongst a group of members emerged as a core dimension of the practice of circumventing and actors engaging in the practice are focused on realizing a specific strategic goal of the organization. This dimension consists of two second-order codes: (1) goal attachment, and (2) identification of micro-operational issues (sensing). The first dimension is an attribute shared by both the formal and informal organization, representative of strategic consensus between both elements. In relation to the formal organization, the new strategy geared towards the dual pursuit of exploration and exploitation is established through formal mechanisms (i.e. senior management) and the implementation process is attached to this strategic goal and seeks to embed it within formal structures and processes.

For the informal organization, goal attachment relates to actors being intrinsically motivated to fulfilling the organization's strategic goal, promoting members to adopt an awareness of the exploration-exploitation agenda within the informal organization. The second dimension, the identification of micro-operational issues (sensing), is a capability shared by both the formal and informal organization, however, how it is manifested in relation to the practice of circumventing is found to be different. In the formal organization, this capability relates to resources where the detection of issues (and opportunities) is an intentional feature of its design. However, with the informal organization it pertains to an organic capability performed by actors who through tacit knowledge and experience perceive and identify, in both the formal and informal organizational elements, operational obstacles and opportunities affecting the effective implementation of formal strategic goals in their daily activities and this is motivated by actors' goal attachment.

### ***Goal attachment***

As part of implementing the new strategic plan at JSC a new organization structure was announced internally in 2014 with the goal to “enhance collaboration and reduce stove pipes and coordinate JSC exploration activities and resources” (Internal JSC document, 2014b), emphasizing internal exploration and innovation activities. The reorganization was motivated by “the need to create a ‘Vision 2.0’

organizational structure and governance model – one designed to advance human exploration and to be more lean, agile, responsive and adaptive to change” (Internal JSC document, 2014a), thus emphasizing the simultaneous pursuit of exploitation activities.

With the practice of circumventing data shows that JSC’s formal and informal organization share a drive to execute its new organizational goals of exploration and exploitation and this defines and shapes the performance of the formal operations by which it functions and underpins the motivations of the emergent practice behaviors displayed by the informal organization. The drive to execute and achieve its strategic goals is evident throughout JSC’s history. JSC was intentionally designed to execute a specific mission – lead in the advancement of human space flight – and since its inception it has been at the forefront of revolutionary technological achievements in this field. For JSC, the execution of the organization’s goals is central to the way in which the organization is formally structured and its prevailing culture:

“The organization, the way it is organized today is around executing with excellence the project or programs and the work we have... (Division Chief, *phase 2*).

JSC’s performance focus on fulfilling its strategic goals exists not only in the formal organization but permeates its informal organization. Informants expressed an innate drive and motivation to achieve JSC’s goals with one informant stating, “we believe we have a void in ourselves without a mission, although it may not be true”. This perception of being attached to the strategic goals of the organization is a feature shared across the formal and informal organization and in this regard they overlap (Soda and Zaheer, 2012), which is important in understanding the practice of circumventing at JSC, although this dimension also indicates a degree of influence held by the formal organization over the informal. For those enacting the practice of circumventing, data shows that the performance drive of goal execution in the informal organization is aligned with achieving specifically goals in JSC’s new strategic change plan, ‘Vision 2.0’. Those engaging in the practice of circumventing have an attachment to strategic goals and are driven to execute and fulfill particular goals defined by ‘Vision 2.0’ in their daily activities. For example, employees expressed the drive to encourage innovative collaboration with external partners, one of the organization’s new strategic goals:

“when I'm out there talking to them [referring to an external partner organization] I paint JSC as willing to be risk taking, able to work with the outside community with systems set up to enable collaboration with the outside world” (Deputy manager).

Other informants spoke of achieving the organizational goal to be ‘lean’ by realizing efficiency in their day-to-day work activities “we have a lot more splinter sections and informal forums where we talk about different things for our office to operate efficiently” (Branch Chief). There is therefore a drive within the informal organization at JSC which is intertwined with the formal organization, to implement strategy and realize strategic objectives. For the practice of circumventing to manifest the data suggests an element of the informal organization must share and adopt the strategic focus as defined by the formal organization to fulfill the organization’s goals in their daily activities, and that this acts as a trigger to the subsequent interactions between formal and informal organizational elements in this practice.

#### ***Identifying micro-operational issues (sensing)***

The data shows that the informal organization contains the capacity to sense and identify, on a micro-level, operational issues (and opportunities) within the organizational environment affecting the implementation and fulfilment of JSC’s ‘Vision 2.0’. This ability to identify micro-level issues spans across JSC’s formal and informal organization and is a trait comparable to Teece’s (2007) sensing category for dynamic capabilities. Official forums and review boards, such as the Flight Operations Panel (FOP), are established formal mechanisms designed to address technical and operational program and project related issues as well as opportunities. Within the informal organization however, it is the unprompted organic identification of micro-level operational issues that emerges. The data show that with the practice of circumventing individuals and groups across various divisions and hierarchical positions sense and informally identify micro-level issues in everyday formal processes or levels of hierarchy impeding the implementation of JSC’s strategic goals in diurnal operations by virtue of their experiential intricate knowledge of the organization’s current processes, systems and scrutinizing its contextual environment. For example, when a team lead (middle manager position) identified an area of inefficiency in

operating practices they remarked: “we were notorious for getting customer surveys and doing absolutely nothing with the data”.

The ability to sense and identify micro-level operational issues and the drive to attain the organization’s formal goals are both strategically orientated characteristics that span across JSC’s formal and informal organization, simultaneously existing in both. Thus, there is a high-order strategy point of overlap and alignment whereby the formal and informal interact (Soda and Zaheer, 2012). The strategic focus dimension plays a role in shaping the next core dimension, prevailing organizational context, by virtue that formal organizational goals will underpin the constitution and nature of formal structures, processes and systems implemented. In addition, it simultaneously drives and shapes the form and perceptions of emergent informal actions and behaviors assumed by actors as they attempt to realize a specific goal. And in relation to the formal organization and the organic capability to sense and identify micro-operational issues (and opportunities), actors exercise this ability by scrutinizing the prevailing organizational context against their perception of the organization’s strategic goals to be realized.

### **Prevailing Organizational Context**

The prevailing organizational context dimension refers to the defined systems and prescribed behaviors that are established by the formal organization, contributing to the established organizational environment that defines the official way of doing things at JSC. The prevailing organizational context at JSC is characterized by variant forms of structure and conformity, in both processes and social behaviors. This represents the formal organization at JSC and stands in contrast to the third core dimension of the practice of circumventing, divergent proactive behavior. Informants recognized the prevailing organizational context, however this recognition was not necessarily confirmation of acceptance by the informal organization. The organizational environment and culture at JSC is complex and comprises many dimensions. However, for this study on the informal organization and the practice of circumventing the findings focus on the second-order codes pertinent to this discussion using three second-order codes: (1) structures, (2) conformity, and (3) strategy specification gap. Structures relates to the organizational design elements governing the core functions of the prevailing organizational context and conformity refers to the conjoining cultural environment that reinforces the formal processes,

procedures and expected behaviors. The third element, strategy specification gap, relates explicitly to JSC's ambidexterity strategy and Center management's promulgation of its strategic change plan to advance the dual pursuit of explorative (innovation) and exploitative (efficient) activities.

### ***Structures***

The data revealed that the cultural context at JSC is defined by formal rigid structures that permeate various aspects of the organization and define processes and procedures. These rigid structures condition and define expected behaviors and consequently define emergent informal practices that differ from the established norms, such as the practice of circumventing, viewing them as unconventional and in conflict to its formally sanctioned contextual norms, and as such can pose resistance to such informal behavior being exhibited. Structures were identified as taking three different forms: (1) hierarchy chain of command, (2) power structures, and (3) tight controls. Firstly, the structure of rank and hierarchical position emerged from the data as being critical to JSC and its operational environment. Informants related that JSC's architecture was highly hierarchical in design, and required that each employee know their position in relation to their superiors and adhere to their chain of command, which is reflected in expected behaviors:

“It's literally, you know your chain of command. You do not step out of your chain of command... There's even some [division areas] that depending on how you email people can get people's knickers in a twist... I've actually worked for people that didn't even like if- if you're writing like three Chiefs and a couple of Leads. You better name your Chief first, then the other Chiefs and then the Leads after them. Don't write your Lead first because that's considered rude. It's a hierarchy.” (Team Lead)

Informants explained that this design was rooted in the organization's military background on which it was founded, and was expressed using militaristic terms in language. One informant exemplified this:

“To this day our agency is really set up like the military. It is all about recognizing and “following your chain of command” or my favorite phrase is “don't break your chain.” (Senior technical specialist)

The second structural form identified is the power structure that is determined by whether or not an employee has been assigned to work on a specific space program. For those assigned a role in one of the major space programs at JSC, this program-role association engenders a power structure that elevates those working on a program above those operating in business related functions or operational Center facility roles outside of a program:

"You're special if you're in a program...power structures can over-ride people, if you're in the "right-org" (Workshop participant).

The data showed that space programs at JSC imbue a power not held by the business/institutional functions because of the financial standing they possess - "...the money goes to the programs, not the Center [institution]...and everything is about budget" (Senior technical specialist). At JSC the allocation of budget is central to all activities and denotes a dimension of power and influence:

"...budget is usually the biggest driver for everything, and what our goal is, and what's set for JSC in [space] exploration" (Contractor).

Tight controls emerged as the third structures subtheme referring to the tight adherence to rules and procedures that create standards across and within divisions of the organization. The formal processes and procedures at JSC are designed around its fundamental mission – to advance human space exploration. For JSC, this mission involves being innovative in order to overcome a number of technological, engineering and physiological unknowns, which is an activity that holds the risk of endangering human life. (A reality known to the organization whose history includes four major flight disasters all resulting in the loss of human life). Informants explained that tight controls are essential given the risky nature of JSC endeavors. However, tight controls are also perceived to overextend into areas without cause, such as the innovation activities and collaboration endeavors – explorative innovation traits the 'Vision 2.0' strategy seeks to enhance. This contextual feature was recognized organically by JSC actors who identified it by means of the informal organization.

"...the business that we do. We have to be very structured, we have to have a lot of rules. But unfortunately, sometimes

that bleeds into things that really don't need to be that structured and ruled based?" (Engineering specialist)

### ***Conformity***

Data also shows that JSC's prevailing organizational cultural environment is characterized by conformity in relation to two elements. Firstly, legislative decrees on processes and procedures restrict the activities permitted by JSC a publicly funded body. For example:

“...procurement is seen as being very clearly defined because they follow procedure and guidelines and timelines that are written in the law, so they have to have lots of controls and structures” (Contractor).

And secondly, conformity in social behaviors within the formal organization that directs formal elements such as career progression:

“There's like a mental socialization that occurs, so if you want to move up then you have to stick to the straight and narrow and not ruffle too many feathers...” (Technical specialist).

### ***Strategy specification gap***

From the data it became evident that the vision of 'JSC 2.0' strategy and its pursuit for innovation and efficiency was not perceived or understood homogeneously by actors.

“If you ask ten different people just working at different levels what JSC 2.0 is, I would guess that you would probably get ten different answers. And someone would say, "I don't know" ... This is more nebulous. More of a grey area...” (Deputy Lead).

In devising the new strategy, senior management had not explicitly specified what being innovative, efficient or lean meant or how it would look operationally when implemented across the various organizational divisions and units. The lack of strategy specification left a translation gap, leaving it open for actors themselves to translate and interpret the strategy and its application within their own divisions using their own cultural references such as their experiential knowledge and perceptions. Consequently, data showed that there were different connotations of innovation and efficiency held by actors. For example, innovation was perceived by one informant to



be process orientated and equated to finding efficiencies: “I guess for me, innovation is the process or the discovery of doing something better, more efficient, different, outside the box, no one has thought of it before” (Branch Chief). Another informant expressed that innovation within their division was seen in terms of diversity and inclusion of people, explaining that innovation is:

“Essentially, that’s diversity, people call it diversity and inclusion, and I like to call it diversity... we link inclusion practices to innovative outcomes as a means of communicating with business imperative for diversity... being inclusive is linked to greater innovation, that by including and valuing everybody, you're going to get better results” (Deputy Division Lead)

Whilst other participants perceived innovation and efficiency as one-in-the-same. One informant gave an example of how their department looked at the mundane audit activities that took place and found ways to avoid overlaps and produce efficiency, and described it as being innovative – “that’s very much an innovation” (Division Head).

The strategy specification gap and heterogeneity of understanding in relation to innovation and efficiency engendered a cultural environment where actors can employ informal means, such as the practice of circumventing, as a way of applying what they saw as innovation and/or efficiency within their particular division and tasks thereby bringing an element of (incremental) change, as highlighted by one participant who spoke of their applying JSC 2.0:

"I'd gotten more traction you know doing my own [innovative] thing and going to a random class then going through the traditional chain"(Team Lead)

### **Proactive behavior (seizing)**

Whilst the previous two core dimensions discussed above involve the formal organization (i.e. the strategic focus dimension spans across both the formal and informal organization, and the prevailing organizational context relating specifically to the formal organization); this third core dimension resides solely within the informal organization. Divergent proactive behavior relates to enacted practices that emerge from the informal organization at JSC whereby actors, upon identifying micro-

operational issues against the prevailing context and having developed individual perceptions of what innovation and efficiency mean operationally due to what is perceived as a lack of defined specificity in the strategy and in management's promulgation of it, actors devise and enact the practice of circumventing to promote exploratory and exploitative activities in order to realize the 'Vision 2.0' strategic goals. Actors devise and execute an action in order to promote and realize the strategic goals of exploration and exploitation, a trait similar to that of Teece's (2007) dynamic capabilities categorization of seizing.

However, in utilizing the practice of circumventing their actions diverge from formal expected behaviors, and are deemed unconventional and divergent because the organization's prevailing cultural context and the formal organization defines them to be so. These informal behaviors do not conform to the prescribed behaviors accepted by the formal organization but are in a state of conflicting tension with it. And it is within this dimension that we find the physical manifestation of the practice of circumventing. Yet in order for this informal behavior to be enacted it requires the conflict with elements of the formal organization to exist. Thus, this dimension is interrelated with and feeds off the previous core dimension discussed above. The divergent proactive behavior dimension is explained by two second-order codes: (1) non-conformist temperament, and (2) enacting practice: circumventing. The non-conformist temperament is an actor's disposition and is an antecedent to the actual enactment of the informal practice. Not all organizational actors exhibiting a non-conformist temperament may necessarily engage in the enacting practice of circumventing, but for those that do this is a necessary condition.

### ***Non-conformist temperament***

Non-conformist temperament refers to organizational actors assuming a disposition that challenges the organization's status quo – elements of the formal organization. This characteristic is the precursor to the physical enactment of the practice of circumventing. For those engaging in the practice of circumventing, they do so intentionally in an effort to challenge the prevailing organizational context, address a micro-operational issue identified in the formal organization and promote the positive pursuit of innovation and efficiency in their operations as they discern it is lacking due to a perceived gap in the strategy's specification. Organizational actors recognize and are aware of the status quo but, having identified an obstacle within the

formal organization preventing a specific strategic goal from being realized, they are proactive and use their initiative in anticipation of engendering a change that reinforces the implementation of a particular strategic organizational goal. This trait is reflective of the concept positive deviance (Spreitzer and Sonenshein, 2003; 2004).

The non-conformist temperament is exemplified by the following informant who having discerned and identified a micro-operational issue inhibiting the attainment of efficiency, the actor formulates and executes a course of action in an attempt to address it and promote exploitation and produce recourse in alignment to the organization's strategic goals:

“This culture is very meeting based. So, what I did, I audited all my managers' calendars and I averaged them. I actually put a price tag too. So, I thought 'how can they say no to this?' They're averaging 27.8 hours of meetings a week that extrapolates to like 1.8 million dollars a year. And I'm like how can this...so I gave them some ways to stop it. They just looked at me like I was nuts. I had a presentation showing the numbers and how I got to the numbers, and here, you can do this, and- It was more like 'how dare you say that we're doing something inefficient'. And I thought okay, maybe they don't want to hear it now but maybe later”  
(Team lead)

### ***Enacting practice: circumventing***

The physical manifestation of the practice of circumventing is rooted within the informal organization and its interaction with, and understanding of formal organizational elements. It can take different forms and can be engaged by individuals or groups at different levels of the hierarchy. The manifestation of the practice goes beyond identifying a micro-operational issue, being proactive and using one's initiative. It goes one step further by intentionally jumping over, or sidestepping, an element of the formal organization – be it a step in a formal process or a position/layer of hierarchy. Therefore, the informal organization is not only capable of highlighting inhibitors to the strategic goals of innovation and efficiency within the formal organization but demonstrates what it perceives to be effective remedial action in an effort to promote and even realize the attain of strategic organizational goals. To illustrate the practice of circumventing being enacted the following present's four vignettes of episodes of the practice of circumventing that occurred and in some cases, were observed by the researcher at JSC, along with the resulting outcomes.

## Reconfiguring: Outcomes

The data suggests that the outcomes to enacting the practice of circumventing produce mixed results. In drawing on Teece's (2007) triadic categorization of sensing, seizing and reconfiguration capabilities the following looks at how the informal practice of circumventing harnesses these capabilities to promote explorative and/or exploitative activity to support the organization's strategic change. However, the study found that the final outcomes from the practice of circumventing varied and were conditioned by two contextual moderators: (1) status held within the informal organization, and (2) formal authority as defined by the formal organization and its design. For those engaging in the practice, their degree of formal authority and informal status was found to have a combined effect on the resulting outcome. Combining data and observations from the study with Teece's (2007) capabilities categorization I develop a classification framework (see figure 6) showing the varied outcomes to the practice of circumventing and suggest that the practice is itself an informal mechanism with the capacity, under certain conditions, to engender and behave as a dynamic capability. First I explain the two contextual moderators and then discuss the various outcomes to the practice of circumventing as conditioned by the two moderators.

		<b>Status (informal)</b>	
		Low	High
<b>Authority (formal)</b>	Low	(A) sense, seize, no action	(B) sense, seize, incremental/task based adjustments
	High	(C) sense, seize, initiate change	(D) sense, seize, long-term reconfiguration

Figure 6: Outcomes to the practice of circumventing

***Moderator of outcomes: informal status***

Status refers to the standing an individual or group has within the informal organization. At JSC informal status is imbued by two factors: (1) ‘who you know’ (a person’s informal network) - “it is about who you know. And a lot of people use that to their advantage” (Office Manager), and (2) tenure at the organization – “I personally would really like to see more respect for ideas no matter where it comes from. You shouldn’t judge my idea no better, no worse just for the fact that I haven’t worked here for 32 years” (Team Lead).

***Moderator of outcomes: Authority (formal)***

Authority refers to the formal standing and ranking position an individual or group possess. Formal authority is associated with both functional operations and official vertical social relations (Diefenbach and Sillince, 2011). At JSC formal authority comes through two factors: (1) positional rank given through its hierarchal structure, and (2) possessing an expert identity (specializing in a technical field or program) – “being a technical expert on something used to get you very far. Um, they would promote you to management” (Office Manager).

***Varying resulting outcomes:***

The research found that informal status and formal authority are contextual moderators and their combined effect impact the outcomes of the practice of circumventing (figure 6). For example, in vignette 1 (see appendix D) the Division Deputy Manager who attempted to circumvent steps in a formal process, the actions of the manager demonstrate sensing and seizing capabilities; in that through experiential knowledge of the internal environment the manager identified a discrete structural inhibitor reducing process efficiency which delayed the advancement of collaborative innovation – a JSC strategic goal. In identifying a process inhibitor in the organization’s formal element, the manager can be seen to have engaged in the practice of circumventing, seizing the opportunity to reduce inefficiency and promote innovation collaboration in this instance by making a distinction between the critical process steps from non-critical steps and engaged in what was perceived as the former in an effort to address the detected issue. In terms of the outcomes resulting from the manager’s action we see management pushback and no further action occurred to

inject a greater degree of efficiency into the process (outcome A in figure 6). Though the manager had tenure at JSC, having worked there for over 25 years, as a mid-level manager they did not possess a high enough degree of formal authority or positional power within the hierarchal structure, and their personal network was not able to influence the relevant people within senior management in order to promote process efficiency.

The remaining outcomes of the practice of circumventing in reference to outcomes (B), (C) and (D) (in figure 6) are exemplified by the following three vignettes:

In vignette 2 (see appendix D), we see a management team employing the practice of circumventing to jump over a layer of hierarchy who were preventing the implementation of a new training plan geared towards achieving efficiency as a routine system. The outcome of the practice resulted in the successful long-term reconfiguration of the formal training system and embedded new processes designed to enable learning and knowledge transfer, aligning to the strategic goal of efficiency. As senior managers, these actors were responsible for designing the new training plan and their position allowed them to monitor its rollout as a whole system. In so doing the managers were able to observe and identify threats and opportunities of implementation (i.e. middle managers). Armed with this knowledge the senior managers engaged the practice of circumventing as a mechanism to address obstacles to the initiative in order to promote improved learning and knowledge transfer competencies across the division. In this instance, the outcome of the practice of circumventing promoted and help support the long-term transformation of the division's knowledge management process (outcome D). It can be seen that the actors engaged in the practice of circumventing were highly ranked positionally and were technically knowledgeable as leaders of their unit, hence the management team possessed a high degree of formal authority. In addition, the senior team also possessed a high degree of informal status given that individuals in this position had worked at JSC for an extensive length of time, which is considered a prerequisite to being in management at JSC: "to get into...senior management grades at JSC you have to be lucky, good, and patient. Or some combination of those three" (Senior Office Manager), and had cultivated an informal network amongst themselves at senior management level, as well as with those lower-down within their division. Hence, the

combined high degree of both formal and informal contextual elements engendered an outcome that reconfigured the division's knowledge management competency, and the practice of circumventing was an informal mechanism utilized to promote efficiency to help achieve this outcome.

In the case of vignette 3 (see appendix D), the practice of circumventing is a mechanism enacted by mid-level managers to overcome structural impediments causing dissonance between upper and lower levels of the organization, and the program's strategy and its implementation. In enacting the practice, the middle managers could explore and devise a change strategy free from restrictions bound within formal structural elements of the program. In so doing, the practice of circumventing not only facilitated the mid-level managers' exploration activities in developing a strategy but also mediates efficiency by allowing the change team to devise the strategy without being subjected to inhibitors in formal structural elements. In terms of the outcomes of the practice of circumventing in this particular case we see it produces two effects. Firstly, as middle managers, the change team did not possess a high degree of formal authority however in receiving direct support from the program executive, their enacted practice of circumventing became vested with high degree of formal authority and sanctioned their change planning efforts. Furthermore, as mid-level managers they possessed a moderate degree of informal status when they initiated the change strategy and so in enacting the practice of circumventing it facilitated the managers in their initial exploration (sensing) of opportunities and obstacles affecting the program's ambidextrous strategy, and was a mechanism that was repeatedly used to support the middle managers in strategizing system and cultural changes across the program (i.e. seizing activities). Subsequently, the practice of circumventing facilitated a transient structural change to the program by placing the middle managers outside the program's traditional hierarchy chain of command and in doing so assisted in initiating change, which is an example of outcome (C) in figure 6. Additionally, the long-term effects of the change initiative developed by the team of middle managers, having enacted the practice of circumventing, promoted long-term permanent changes to formal systems and processes in the program. The repetitive engagement of the practice of circumventing endorsed by the program executive along with the team lead's integration in

management engendered the long-term reconfiguration of the program's resources, illustrative of outcome (D) in figure 6.

Vignette 4 (see appendix D), demonstrates the practice of circumventing from the ground up, and is an example of outcome (B) in figure 6. In this case the practice of circumventing is the mechanism that facilitates junior employees to voluntarily step out of their daily routines and roles and promotes them to identify and voice opportunities for innovation and efficiency within their work areas, and in some cases, it facilitated junior employees in implementing incremental task specific changes relating to their particular roles and interests. The junior employees enacting the practice of circumventing possess low formal authority but their informal status, by virtue of their network and connection with senior management, who are themselves involved in the practice, meant that these junior level employees were supported by those who possessed a high degree of authority (i.e. management) to exercise the practice of circumventing leading to some positive incremental outcomes promoting exploration and exploitation activities beyond the normal routines of organizational actors. This finding extends Penny's (1967) concept of "substitute locomotion" which argues "that informal communication to a higher status person may be used as a substitute for an actual increase in status" (p. 271). For in having access to and support from senior ranked managers, this served as a proxy endowing junior ranked employees with high informal authority. It also demonstrates the interaction between formal social structures and unofficial informal relations between employees and senior managers, where the former is drawn into enacting, and in some cases legitimatizing, informal practices.

## **DISCUSSION**

This paper set out to explore how the formal and informal organization interact in practice, what arises from this interplay and how it influences the organization in operationalizing a dual strategy of exploration and exploitation. The study takes a practice orientation to dynamic capabilities and adds to work in the field. This approach provides the prospect of greater granularity in understanding real-



world interaction of the formal and informal organization, and the actors situated within them. The research focuses on the enacted behaviours of employees from multiple levels of an organization under the condition of strategic change. Through an ethnographic examination conducted at the NASA Johnson Space Center (JSC) during its implementation of ambidextrous strategy, the study demonstrates how the interaction between the formal and informal organization engenders the emergence of an informal enacted practice, where elements of the formal and informal organization are engaged and overlap. This emergent informal practice is a mechanism exercised to promote exploration and exploitation activities by motivating change in functional features of the formal organization perceived to hinder the manifestation of the organization's strategic goals for efficiency and innovation. I term this enacted practice as "*the practice of circumventing (POC)*" - the deliberate side-step or jump-over either a formal process, elements within a process, or layers of hierarchy with the intention of achieving change in support of the strategic ambidextrous objective. The findings show that the method in which informal elements interact with the formal organization is revealed through the enacted practices of organizational members; a view which is consistent with activity theory and demonstrates a complex interrelationship involving structural and social elements (Marx and Lechner, 2005) as influencers upon the implementation of strategic goals within operational activities.

The term 'circumventing' is referred to as a negative dissenting pattern of behavior in organization communication literature (Croucher, Kassing and Diers-Lawson, 2013; Kassing, 2007). However, this study provides another perspective of circumventing, demonstrating it as an advantageous embodied practice which, under certain conditions, has the capacity to promote exploration and exploitation and can contribute to supporting organizational change. The analysis reveals that POC goes beyond being an upward verbalized expression performed by an employee against their immediate supervisor (Kassing, 2002). Rather, it extends beyond side-stepping an organization's official communication structures to include the deliberate sidestepping of a process, steps in a process or layers of hierarchy to achieve change in alignment with the organization's strategic intent for exploration and exploitation. The findings show POC is not restricted to the supervisor-subordinate dyad as conceived in dissent literature (Kassing, 2002; 2007) but has broader application to formal structural features (i.e. processes, systems, procedures), and can be exercised by upper-, middle-managers, ground-level employees and teams. Furthermore, the study shows that

POC is not unidirectional, occurring in an upward dissenting direction (from the bottom-up), but also occurs bi-directionally enacted downwards (top-down) by management. This fluid multi-directional movement is reflective of Krackhardt and Hanson's (1993) proposition that the informal is capable of moving diagonally and elliptically, skipping entire functions and furthers our understanding by providing empirical evidence of how such movements are manifested.

Figure 7, presents an empirically-grounded model of the practice of circumventing and shows the central organizational and behavioral dimensions that interact to enable the practice, the location in the formal or informal organization, and the direction of influence. The model shows the two constituent elements of the organization's context, and that formal and informal organizational elements not only coexist but that degrees of consistency (overlap) and inconsistency (no-overlap) (Soda and Zaheer, 2012; Gulati and Puranam, 2009) occur simultaneously between these elements, highlighting complexity in its interaction.

### **POC: Dynamic capability microfoundations**

Dynamic capabilities research centres on understanding how organizations achieve long-term change for competitive advantage. Teece (2007) conceptual disaggregation of dynamic capabilities defines three core underpinning processes: the capacity to *sense* opportunities and threats, *seize* opportunities and execute, and *reconfigure* and enhance resources for long-term sustainability. The representation of POC in figure 7 explicitly demonstrates that each of these three core processes are present and active in POC through the interactive engagement of formal and informal organizational elements.

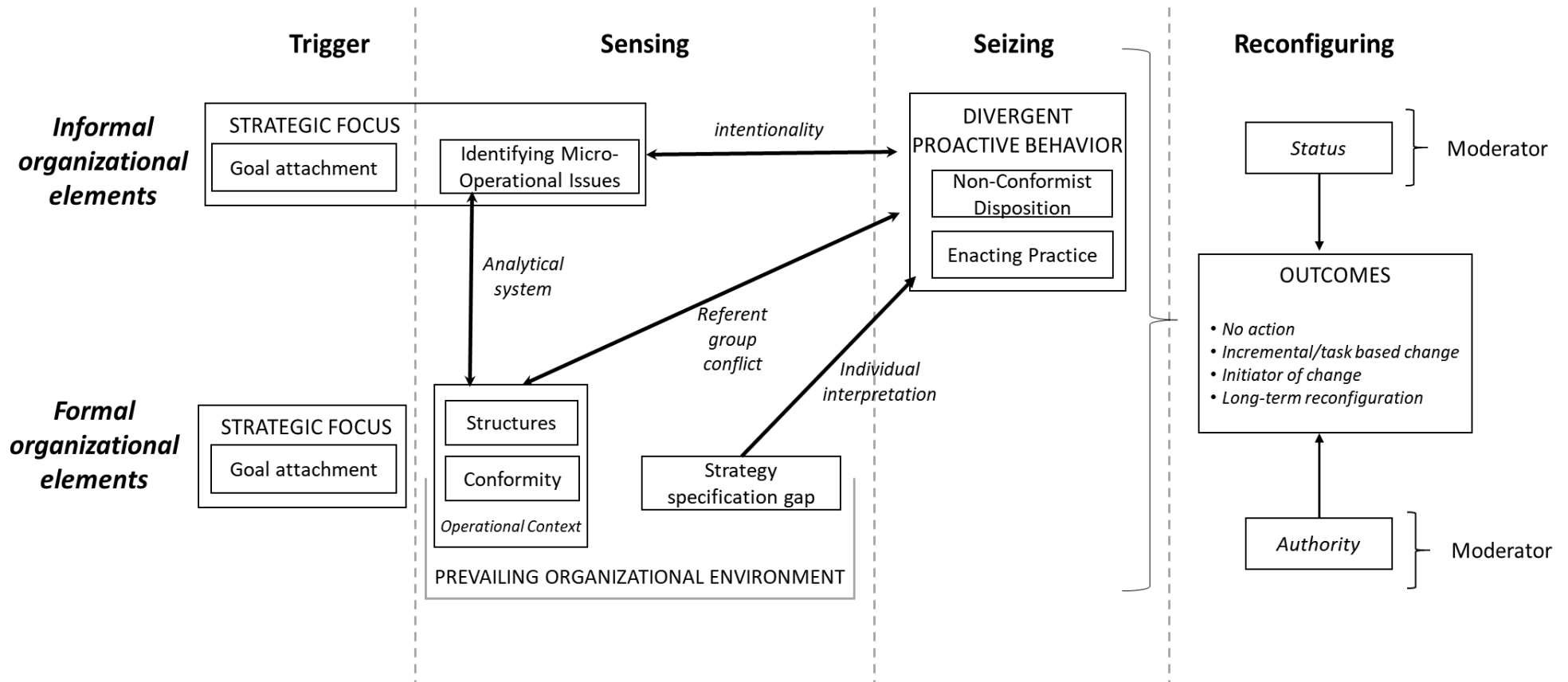


Figure 7: Framework of the practice of circumventing and the microfoundations of dynamic capabilities

The data indicates that POC is triggered by the actors' attachment to the strategic goals established by the organization's senior management, and this dimension was found to be present across the formal organization, where strategic objectives are established by senior management, and the informal organization. The trigger dimension is an indication of the presence of strategic consensus within both the formal and informal organization. Strategic consensus refers to a shared understanding and agreement of the organization's strategic priorities, thus allowing the coordination and implementation of strategy (Walter, Kellermanns, Floyd, Veiga and Matherne, 2013). It has been hypothesized that congruence between individual actors and organizational goals are greater at higher levels of hierarchy, under the premise that the salient goals within the formal organization are those of senior management, whilst those of the informal organization are that of individual actors and employees (Farris, 1979). However, POC reflects a divergent view with actors' showing strategic consensus resident within the informal organization, suggesting the goals held within the informal organization, including lower level employees, can be in alignment with the strategic goals of the organization. This concurs with Garner's (2015) empirical study that demonstrates that behaviors exhibited by the informal organization can arise from an individual-level attachment to the organization's formal mission and goals.

Within the informal organization, the goal attachment dimension is a direct antecedent to the sensing process, the first component of dynamic capabilities, *sensing* (Teece, 2007). As figure 7 illustrates, within the informal organization, sensing reflects the actors scanning the internal and external context, and identifying the issues and operational inhibitors hampering the organization's strategic objective. This sensing process occurs as a result of a dynamic analytical system, whereby the actor interactively engages with the operational context (i.e. structures and systems) determined and shaped by the formal organization. The data suggests that the analytical system at play during sensing is an implicit one with actors assessing the organization's prevailing organizational environment not by means of a formalized procedure directed by senior management but voluntarily through informal channels.

Having detected lags and impediments within the organization's operational context and formal systems hampering the effective implementation of exploration and exploitation, the second stage of dynamic capabilities, *seizing* (Teece, 2007), becomes active. With POC, the seizing capability relates to the enactment of divergent

proactive behavior, the performance of POC. POC is characterized as divergent because, for the actors who engage the practice, it is an unconventional way of performing that sits outside the organization's operational and cultural norms. The data therefore suggests that POC is an empirical example of positive deviance in practice for it is "a departure from organizational norms prescribed by formal and informal organizational policies, rules and procedures", and "institutionalized expectations" (Spreitzer and Sonenshein, 2003: 208). A defining feature of positive deviance is understanding the norms and expectations shared within a unit or organization because it establishes the referent group and dictates whether a behavior is deemed divergent and deviant or acceptable (Spreitzer and Sonenshein, 2004). For JSC, the data shows that the cultural context is characterized by rigid structures and conformity in behaviors and formal regulated processes and procedures. Actors who enacted POC exhibited non-conformity to the prevailing context and were therefore in conflict with it. Those enacting the POC do so with the knowledge that their behavior is unconventional, is in conflict with the prevailing culture and may be perceived by others negatively.

Another key feature of POC is the relationship between the sensing process (i.e. strategic focus and identifying issues) and the seizing process (i.e. the enactment of POC). The data suggests that this relationship is conditioned by the construct of intentionality - "the pursuit of particular "ends" i.e. desired outcomes of the action, through the employment of available "means" i.e., anything material or immaterial that is instrumentally used in an attempt to achieve these outcomes (Whitford, 2002)" (Dittrich and Seidl, forthcoming, p.7) (see figure 7). Spreitzer and Sonenshein (2004) explain that intentions behind deviant behavior is a central criterion for positive deviance and should be motivated by an honorable purpose, although the authors note that 'honorable' is an open term. Drawing on MacLean, MacIntoch and Seidl's (2015) brief on the distinction between the teleological and non-teleological notion of intentionality, POC appears to be an example of the former for the actors who engage in the practice "are guided in their activities by the preconceived ends that they try to realize through a process of mobilizing the means that the situation offers" (p, 345). Hence, the actions of POC are steered by the formal predefined strategic goal to enable and further exploration and exploitation activities at ground level and this directs their efforts. Nevertheless, they proceed to enact POC because they are motivated by goal attachment to the organization's strategic focus, and perceive the

successful attainment of the end goal has a value that extends beyond themselves and benefits the organization as a whole. The traditionally held assumption considers those who deviate from norms and standard behaviors through the informal organization are disloyal or resistant to positive organizational change (Kranckhardt and Hanson, 1993). However, the findings of this study indicates that this assertion is not wholly accurate. POC shows evidence of actors engaging in the practice deviating from formal norms intentionally not as a means of resistance, but in an effort to effectively implement strategic goals of the organization and provoke a degree of change. As such, it could be argued that POC combines both constructive and destructive behaviors as defined in the new meta-theory for deviance (Warren, 2003). Those enacting the practice view their behavior as constructive, whereas those either being circumvented or observing POC in action may perceive it as destructive to both the status quo, formal systems and ways of operating. This line of investigation – the perception and reaction of those being side stepped - was not something considered in this study and presents an avenue of further inquiry.

Furthermore, in utilizing the informal organization and informal practices as means to overcome the inefficiencies and impediments contained within formal organizational systems and structures preventing the desired outcomes, actors engaging in POC perceive and utilize POC as a practical solution. In this regard, POC takes on a situational dimension because actors having interpreted the prevailing organizational context in which they are situated, and its misalignment to the desired end goal, are then provoked to respond and deal with the situation (MacLean et al, 2015), within the sphere of their role. Interestingly, a feature of POC stems from the individuals interpretation of the strategy and their perception of the organization. The data shows that POC occurred in a context where the definition of innovation and lean efficiency was not universally understood by actors within the organization (strategy specification gap). It highlights the significance of not having a clearly articulated and universally understood meaning of innovation and efficiency, and what its corresponding behaviors look like. A finding that concurs with Markides et al (2017) who report similar outcomes in their study of organizational agility.

### **Reconfiguring: POC outcomes**

The last phase of POC relates to the third process underpinning dynamic capabilities – *reconfiguring* (Teece, 2007). Within dynamic capabilities theory, this third

process relates to realigning/enhancing resources to transform the organization's capabilities and resources for long-term sustainability (Teece, 2007). For POC, this feature equates to the outcomes of the practice and its long-term effect. Actors who engaged POC were motivated by a strategic affiliation to JSC's ambidextrous strategy and utilized POC in an effort to promote and better enable exploration (innovation) and exploitation (efficiency) and affect change by overcoming threats and impediments within the formal organization. However, the findings indicate that the outcomes of POC are mixed, ranging from inaction to facilitating long-term change in organizational resources in support of exploration and exploitation activities. The data indicates that the outcomes of POC are moderated by two endogenous contextual factors rooted in the formal and informal organization – formal authority and informal status (refer to figure 6).

The vignettes from the case analysis (appendix D) illustrates how POC in action may begin with a strategic intention to make adjusts and/or change in the formal organization processes, structures or systems, but this does not necessarily materialize in long-term change due to reasons rooted in an actor's informal status, vis-à-vis social capital (Helfat and Martin, 2015); and their authority, as defined by their role and hierarchical position. The findings show that formal authority and informal status are important contextual moderators whose combined effect, depending on the degree to which they exist, affects the various outcomes of the practice. When actor(s) possess a high degree of formal authority and informal status POC becomes a mechanism with the capacity to promote explorative and exploitative activities by engendering change in features within the formal organization that are inhibiting the successful implementation of explorative and exploitative activities. This demonstrates a dynamic mode of interaction characteristic of strategic change. This finding implies that existing conceptualizations of the modes of interaction between the formal and informal organization are insufficient and suggests that other interactive modes previously unconsidered may also be in existence. Some organizational actors utilized POC as a way of enacting new ways to do day-to-day routines more efficiently, and others engaged POC as a tool to induce innovation.

In outlining the key features of dynamic capabilities Ambrosini, Bowman and Collier (2009) note that they become “embedded in the firm”, and can take the form of ‘routines’ or ‘organizational processes’ purposefully utilized to “reconfigure the firm's resource base by deleting decaying resources or recombining old resources’ in

new ways” (p. S11). The informal and formal organization are embedded features of an organization, and the former has idiosyncratic tendencies. The findings indicate that the employment of POC within the context of this study resembles Ambrosini et al’s (2009) concept of dynamic capability, in being a practice, though emergent and informal, is motivated to bring change in the organization’s resources.

Teece (2012) explains that “unlike ordinary capabilities, certain dynamic capabilities may be based on the skills and knowledge of one or a few executives rather than organizational routines” (p. 1395). However, the data extends our understanding of dynamic capabilities by showing that the capacity to perform sensing and seizing processes constituting dynamic capabilities is not limited by seniority in hierarchy, but that actors at all levels of the organization have the potential and some do so using experiential knowledge and some form of informal, unofficial means to assess existing formal context against explorative and exploitative goals. In being enacted at multiple levels – the single individual, a group of individuals, and a level of hierarchy (i.e. senior management) – POC is consistent with activity theory’s conceptualization of organizational actors as those who interact decisively and intentionally with their contexts (Jarzabkowski and Balogun, 2009) contribute to understanding that organizational members at all levels engage with both the formal and informal context in their daily activities and that these domains are interwoven at all levels of organizational hierarchy.

Furthermore, the study shows the enactment of informal practices such as POC is a distinct knowledge orientated capability based on the experiential skills and comprehension of actors concerning organizational routines and operations, and this assists their identification of internal obstacles, and formulation of remedial plans to bring about an adjustment or change in the internal context that is conducive to the strategic goals. In essence, POC corresponds with Schreyögg and Kliesch-Eberl (2007) view of dynamic capabilities as ‘*distinct* behavioral patterns’ involving both formal and informal elements and activities, which provide a means of overcoming barriers and rigidities existing within an organization’s routine operational capabilities (p. 914).

### **Interaction of the formal and informal organization**

The study identifies POC as an interactive mechanism through which employees simultaneously engage formal and informal organizational elements in an attempt to overcome perceived structural rigidities, a behavior which parallels



Diefenbach and Sillince (2011) participatory organization. POC provides an empirical demonstration of how the interaction between formal and informal elements has a joint effect (McEvily et al, 2014) through actors' enacted practices, and gives rise to unconventional behaviors that are not assembled but emerge organically, contingent on the environment in which it exists. The theoretical framework presented in this paper draws upon organizational design and behavioral perspectives to suggest that the modes of interaction between the formal and informal organization are diverse and dynamic. POC demonstrates that in actuality the interaction between the formal and informal organizational elements is an integration of behavioral and organizational design perspectives. In the study, organizational actors enacting POC perceive an inconsistency between the strategic goals the organization aims to realize (exploration and exploitation), and its formal prevailing systems and environment. In reaction to identifying inhibiting issues the informal practice of POC is enacted as an autonomous act outside the established norms and routine activities of individuals (Burgelman, 1983), pushing in a direction different to the formal organization. Yet with POC, the study found that the interaction goes beyond the informal organization offsetting or compensating for the weaknesses in the formal (Gulati and Puranam, 2009), but under certain conditions can provoke changes in formal systems.

Whilst research (Gulati and Puranam, 2009; Zenger, Lazzarini and Poppo, 2002; Kang, Kang and Kim, 2017) suggests that the formal organization (normative social systems) can be changed relatively quickly, whereas the informal organization (emergent social interactions) is subject to limits and lags in adjusting to the new formal organization and may be slow to change (i.e. inertia within informal institutions slows the pace of change). However, POC provides a challenge to this view, and suggests that informal emergent mechanisms can be enacted by actors and contribute to the change process. Furthermore, the study implies that in practice elements of the formal organization can sometimes lag behind and struggle to change, and in such cases informal practices such as POC provide a transient rectification mechanism, a view reflective of Gulati and Puranam's (2009) concept of compensatory fit. This reflects Friedrichs (2015) view of the influence the informal organization has on firm functioning in promoting individuals to 'behave innovatively and spontaneously' (p.174) by identifying flaws, areas for improvement, and ways to contribute to the organization's innovativeness. Furthermore, POC contributes to literature by providing empirical support to the proposition that the informal organization, and by

extension informal practices, are influenced by and also have the potential to influence features in the formal organization (Mintzberg, 1979).

For practitioners, this inconsistency suggests the formal structural context designed by management cannot guarantee optimal implementation of strategic goals and that employees from the ground up have the capability to identify operational weaknesses and engage in remedial informal practice to implement strategic goals more effectively. This finding implies that the informal organization and its interaction with the formal organization should not be disregarded even when the informal appears to be divergent from formal systems, norms and expected behaviors (Gino, 2016). The practice of circumventing demonstrates that informal practices emerging in conflict with the formal organization can be a mechanism for supporting the implementation of strategic goals and promoting change.

### **Directions for future studies and practical implications**

Firstly, with respect to the interaction between the formal and informal organization, it would be useful to expand this investigation of the informal organization to other organizations whose organizational context may differ to that of this case study. Such an exploration will provide greater depth and insight into whether the practice of circumventing manifests differently in other organizational contexts, and could shed light on other possible contextual moderators affecting outcomes which may lead to the discovery of other uncovered results. Secondly, this study focused on the internal environment of the organization, however our understanding of the informal organization, how it interacts with formal elements and the flow and nature of influence between these elements could be furthered with research exploring the strategic context external to the organization and its effects. We note the significance of legislation in the case of JSC and its shaping role, but the effect of broader external context including professional communities, customers and partners could be further explored in recognition that autonomous initiatives are not singularly directed by the internal context (Bower, Doz and Gilbert, 2005). And thirdly, the study highlights the role the interplay between the formal and informal organization has as a dynamic capability, and notes the contribution informal practices such as POC have as a supporting mechanism of change. Future studies could expand upon the informal organization from a dynamic capabilities perspective and explore what other mechanisms manifest as part of this process.

In terms of practical implications, this study's exposition of the interaction between the formal and informal organizational elements may give managers and employees deeper insights into the role and significance of informal behavior during transitions in which a new strategy is being implemented and can help them to better understand and frame their actions in light of the possible outcomes that may result. The study also confronts the notion that organizational problems should be funneled by managers through formally designed structures and procedures to designated decision makers (Galbrith, 1977) because effective identification of threat, obstacles and inefficiencies and the formulation of appropriate remedial actions can also take place by and through the informal organization and informal practices enacted by those in non-managerial as well as managerial positions. The implementation of strategic organizational goals is renowned for being difficult. This study and the identification of POC challenges current theoretical perceptions of circumventing, suggesting that our view of the action should not be limited to dissent strategies or negative behavior. In certain contextual environments and strategic situations the practice of circumventing represents an unconventional combination and series of interactions between formal and informal organizational elements with the potential to promote explorative and exploitative activities acting as a supportive mechanism to implement strategies geared towards ambidexterity. Hence, solutions to issues of strategy implementation and contextual alignment to strategic goals may not lie purely in the formal organizational elements but can emerge organically from innovative unconventional informal practices to the benefit of the organization and aid in developing capabilities.

# Chapter Four

## Historical embeddedness, crises and its influence on the pursuit of organizational ambidexterity

### INTRODUCTION

The adage, “history matters”, has verisimilitude in organizational theory and strategic management research. Scholars acknowledge that an organization and its functional context are shaped by its historical embeddedness, defined herein as the way in which sociohistorical environments characterize an organization’s strategic processes, practices, way of behaving and our perceptions of them (Vaara and Lamberg, 2016). Vaara and Lamberg (2016) go on to explain that in emphasizing historical embeddedness “one should not merely place processes and practices in context but also understand their inherent historical nature and construction” (p. 634). While history is recognized to be of importance, there is growing debate as to the role history plays in organizational management. Scholars increasingly voice the need for research to give more theoretical and empirical attention to history and its influence (Kipping and Üsdiken, 2014). The contention that history influences an organization’s present utility suggests that if we are to gain a deeper understanding of an organization’s transition and approach to ambidexterity one must also account for the organization’s history. Hence, understanding *how* history influences an organization’s current strategic context has value in furthering theoretical development and practical application (Jones and Khanna, 2006).

To date theories and studies examining how an organization simultaneously pursues exploration and exploitation, its antecedents and contributing factors, are

largely ahistorical. Organizational journals have increasingly sought to engage historical evidence in examining contemporary phenomena and outcomes, such as organizational processes (Pettigrew et al, 2001), organizational identity formation and transition (Meyer, Bartunek and Lacey, 2002; Tripsas, 2009) and the strategic change process (Agarwal and Helfat, 2009). Reviews of extant management literature show history has, for the most part, received either little attention (Clark and Rowlinson, 2004; Kipping and Üsdiken, 2014), or been treated as ‘supplementarist’ (Üsdiken and Kieser, 2004; Üsdiken, Kipping and Engwall, 2011). In the context of organizational change, Suddaby and Foster (2017) observe that existing theories generally contain implicit assumptions of history. However, in analyzing organizational change some studies have sought to explain the role of history explicitly by examining founding conditions and the concept of imprinting (Boeker, 1989; van Driel and Dolfsma, 2010), the role and influence of founding entrepreneurs (Bryant, 2012; Ellis, Aharonson, Drori and Shapira, 2017), and the influence of path dependence on strategic choice and change (Sydow, Schreyögg and Koch, 2009; Schreyögg and Sydow, 2011).

One area of interest pertinent to organizational history, and a core feature of this paper, is the frequently observed phenomenon organizational crisis.

Organizations, irrespective of their industries, are not immune to crisis events and must deal with exogenous threats (i.e. regulatory changes, technological advances and innovation) as well as internally provoked incidences. Crises are viewed as defining moments in an organization’s history, for they have a significant effect on long-term strategic efforts, innovation and structure (Seeger, Ulmer, Novak and Sellnow, 2005). Maitlis and Christianson (2014) note that crisis events represent influential sensemaking triggers and play a central role in shaping an organization’s developmental trajectory. Yet, to date crisis as a concept has been undertheorized (Sarkar and Osiyevsky, 2017), and less attention has been given to looking at how historical crisis events in an organization’s past influence its contemporary setting for strategic change towards ambidexterity. Thus, in order to understand an organization’s present approach to strategic change in pursuit of exploration and exploitation, one needs to consider how crises embedded in an organization’s history affect and shape the organization. This study, therefore, is motivated to address the research question: *how do historical events in an organization’s past influence its contemporary approach to strategic change, and what role do historical crises play in its joint pursuit of exploration and exploitation?*

To address this research question a longitudinal case analysis was conducted of the NASA Johnson Space Center (JSC), an established organization in the process of transitioning to an ambidextrous strategy and the joint pursuit of exploration and exploitation. Founded in the early 1960's, the study examines JSC's 50 year history which is marked by significant technological achievements, periods of organizational change and a series of major crisis events. This organization, therefore, provides an opportune setting in which to examine the influence history, and in particular crisis events, has upon an organization's modern transition and approach to ambidexterity. The study found that organizational history has a multidimensional influence on an organization's strategic transition towards ambidexterity by stimulating adaptive change *and* inertial tendencies simultaneously. Case analysis identified two historically embedded concurrent processes which shaped the organization's ongoing ambidexterity strategy. The first process identified has been labeled *sustained imprinting*, and refers to the perpetuation of founding characteristics as a result of an organization's historical achievements. Sustained imprinting incited friction with the new ambidextrous strategy by engendering competency traps and inertial tendencies in an effort to preserve its historical achievements. The second process refers to *reprinting* and occurs as a result of historical crises and the organizational trauma experienced as a consequence. The study found that crisis events characterized by trauma within an organization's history provoked the organization to adapt and develop new characteristics and modes of operating to enhance improvements to benefit its future endeavors and prevent future trauma events. At the same time, reprinting stimulates rigidities and constraints which redefine the parameters of future exploration and exploitation activities. Consequently, the study contributes to our understanding of history as an ongoing present (Schultz and Hernes, 2013), whereby past achievements and previous crises experiences continually influence an organization's present strategic activity and shapes its future conditions relating to strategic change. It also shows how the parameters circumscribing an organization's joint pursuit of exploration and exploitation are progressively redefined by historical crisis and trauma events.

I begin by reviewing literature on organizational history, focusing on theoretical concepts that apply to the context of organizational change. For an established organization, the transition to a strategy targeted towards the joint pursuit of exploration and exploitation constitutes a planned change process and evokes

organizational adjustments, be it in structure, cultural context, and operational activities. Exploration activities involve innovation, risk taking and openness to new knowledge, whereas exploitation refers to efficiency, strict controls and variance reduction (March, 1991). Hence, organizational change towards ambidexterity would seek to accommodate the requirements of both activities.

Given the application of organizational change relevant to this paper, the literature review in the next section discusses theoretical concepts pertinent to organizational history, change and crises. I subsequently introduce the empirical case study, explicating the various data sources, and then discusses the findings emerging from the research, its theoretical contribution and practice implications.

## LITERATURE OVERVIEW

### **Organizational history and change**

Within management literature, conceptualizations of organizational change hold implicit assumptions of history and its influence on change (Suddaby and Foster, 2017). Existing management and organization literature approach to history is latent in nature, with few studies explicitly engaging with history empirically or theoretically (Kipping and Üsdiken, 2014). Kipping and Üsdiken (2014) argue that a crucial issue for management research when engaging with history surrounds being explicit in how it relates to theory. In theorizing history, the authors make a distinction between “history *to* theory” and “history *in* theory” (p. 535); whereby the former uses history as evidence to develop, modify or test theories, whilst the latter integrates history within theory and pays attention to nuances specific to the historical context whilst considering how this may influence subsequent developments. Suddaby and Foster (2017) call for research to demonstrate ‘historical consciousness’ by giving explicit attention to history and how it frames our understanding: “rather than adopting an essentialist view of history as a set of immutable facts that must be overcome by constructing an artificial break or rupture with the past, our core insight is that successful change can occur by reframing our attitudes and preconceived notions about the past” (p. 34). Within the field of management, gaps remain in our

understanding of how history influences strategic processes and its resulting effects, and how the sociohistorical context links to and shapes strategic practices (Vaara and Lamberg, 2016). The intention of this paper, therefore, is to address the aforementioned gap and explore how an organization's sociohistorical environment influences its transition towards organizational ambidexterity, and the consequences historical embeddedness has on how the dual pursuit of exploration and exploitation is approached by an organization and its employees.

For an established organization operating a single or dominant strategy (Porter, 1980), the adoption and transition to an ambidextrous strategy, driven by the simultaneous pursuit of exploration and exploitation, constitutes an organizational change process. In reference to this study, exploration relates to openness, risk taking, innovation and new learning, whilst exploitation refers to variance reduction, strict procedural controls, and efficiency and performance stability (March, 1991). Both activities necessitate different requirements and require changes in the organization's operations and perceptual framing and logic if it is to achieve ambidexterity. Yet, organizational change is recognized by managers and scholars to be a challenging and difficult endeavor, and academics and practitioners have sought to understand the issues underlying organizational change (e.g. McKinsey & Company, 2014; Sastry, 1997; Todem By, 2005). This exercise that has culminated in an abundance of change strategies and models designed to instruct managers in effectively managing their organizations during discontinuous change (Kotter, 1996, 1997; Lewin, 1951 cited in Burnes, 2004). Van de Ven and Poole (1995) contend that organizational change encompasses perceiving a visible difference in an organization's form or state of being (e.g. services or product offerings, strategy, role and tasks of individuals or teams). Change consequently alters specific key variables that influence employees and their work-related behaviors.

In recent years, research has increasingly begun to take a historically informed approach to examining organizational change in various practices and structural arrangements (Üsdiken et al, 2011). To date, change models hold implicit assumptions of history and its influence on the change process. Scholarly examination of history tends to perceive it as an obstructive influence with studies drawing on concepts such as founding imprints, path dependency, and inertial forces; and are constructs within Suddaby and Foster (2017) epistemological assumption of 'history-as-fact'. Üsdiken et al (2011) refer to the ecology perspective of organizational change as a difficult



endeavor owing to the view that organizations become characteristically rigid with age and size over time and, therefore, seek to preserve stability and continuity rather than adapt and change. In this context, history is deemed an internal inertial force constraining organizational change. Therefore, it is to be expected that an established organization accustomed to operating a dominant strategy to which it has committed resources over time, would contend with resisting and constraining inertial forces, imprinted characteristics and processes when attempting to change its strategic course of action. However, Suddaby and Foster (2017) posit an alternative view noting that “history actually offers a valuable but underexploited organizational resource that can be used to motivate and successfully manage change” (p. 34). The following focuses specifically on one history related concept pertinent to this paper’s discussion and theoretical development – imprinting.

***Imprinting:*** Originating from the field of biology and the work of Stinchcombe (1965), imprinting refers to the enduring effect founding environmental conditions have on shaping elements or characteristics of an organization despite subsequent changes (Simsek, Fox and Heavey, 2015). As a distinct concept, imprinting remains undefined within extant literature. Simsek et al (2015) develop a conceptual multi-process framework of imprinting suggesting that imprinting is not a one-off occurrence in which environmental factors are branded upon an object but rather consists of three processes “in which an imprint is formed (*genesis*), evolves and morphs (*metamorphosis*), and eventually becomes manifest in outcomes (*manifestations*)” (p. 289. Italics copied from original). Hence, Simsek et al’s (2015) framework implies imprints may not necessarily remain static or fixed but can over time assume a dynamic evolving quality.

In conceptualizing the imprinting concept scholars identify three defining features (Marquis and Tilcsik, 2013). Firstly, imprinting requires the existence of a transient sensitive period during which time the organization is susceptible to and shaped by the environmental conditions existing at the time. This focus on sensitive periods aligns with Simsek et al’s (2015) *genesis* process and represents the initial process when imprints are formed by internalizing ‘imprinter’ (Simsek et al, 2015: 293) features to become traits, routines, and structures. A number of organizational studies from an array of fields have focused on an organization’s founding and formation as the key sensitive period in its development (e.g. Boeker, 1989; Hannan, Baron, Hsu

and Koçak, 2006; Johnson, 2007; Perkmann and Spicer, 2014). However, this focus on the founding sensitive period raises questions as to whether organizations experience multiple sensitive periods post founding, the causes of these episodes and the longstanding effects of such sensitive periods (Johnson, 2007). Van Driel and Dolfma (2010) theorize that imprinting “is unlikely to be a ‘one-shot’ phenomenon”, but rather a repeated process that conditions and locks-in the organization, “where lock-in is a dynamic phenomenon, representing continuity and not rigidity” (p. 38). In addressing sensitive periods, Simsek et al (2015) review imprinting literature and note that some studies acknowledge the occurrence of sensitive periods post an organization’s founding which influence the formation of new imprints (e.g. discontinuous change, new market and/or product entry, leadership transitions and succession, shock and/or crisis events). However, the authors assert that “imprinting scholars have developed only a cursory understanding of the notion of sensitive periods” (Simsek et al, 2015: 307), and calls for research to bring more specification to the nature or boundaries of such sensitive periods both at founding and post-founding. In looking at the evolution of strategy in semiconductor companies Boeker’s (1989) findings extend the imprinting concept beyond the significance of founding conditions. Boeker (1989) finds that events subsequent to the organization’s founding also play a significant role in “either limiting or encouraging change in strategy” (p. 509); and that the degree to which a founding strategy is perpetuated throughout the course of an organization’s history is influenced by conditions and events after its founding. Although the findings highlight the shaping influence of post-founding events Boeker (1989) does not explicitly specify what type or form these subsequent events take or their effects. Furthermore, studies in the field of strategy pay little attention to the actual mechanisms and processes by which imprinting (at founding or post-founding) actually occurs. Hence, there is a need for a clearer understanding of the processes involved in imprinting, its creation and its performative outcomes (Johnson, 2007); and further suggests the need for greater exploration into post-founding sensitive periods.

Secondly, conceptualizations of imprinting generally emphasize the main factors shaping and determining the organization’s characteristics and structures (Simsek et al, 2015). The external environment was the initial concept purported to influence and impress attributes upon the organization that reflect the time period. Studies have identified a number of environmental factors such as founding economic

and political conditions (Kriauciunas and Kale, 2006) and exogenous shocks and cultural context (Dieleman, 2010). Interestingly, Kriauciunas and Kale's (2006) examination of transition economies in the early 1990s shows how firms underwent strategic change from a socialist-orientation to a market-orientation, and that changes in the external environment necessitate changes in the organization's internal structure. The authors conclude that the sudden change in the market environment pressured firms to adapt their performance and that socialist imprinting negatively influenced the firm's ability to change its knowledge sets, and search process for new knowledge within the new market context.

Studies have also cast individuals as a conditioning shaping force on imprinting by virtue of their personality and cognition, background, social networks and identity (Simsek et al, 2015) referring to founders, entrepreneurs or founding teams (Boeker, 1987; Bryant, 2012; Zheng, 2012). Founders are a product of their environment and as such transfer and imprint characteristics of their time and place onto the organization through their experiences and knowledge of the environment (Simsek et al, 2015; Ellis, Aharonson, Drori and Shapira, 2017). For example, Johnson's (2007) historical study on the founding of the Paris Opera and 'cultural entrepreneurship' reveals the significant role played by managers and entrepreneurs in selecting contextual attributes specific to the time in an effort to achieve fit with the external environment, and these attributes become longstanding characteristics impressed on the organization. Other studies show that individual characteristics of the founding individuals, such as vision, can influence imprints on strategy, processes, structures and organizational forms (Johnson, 2007). Employing a genealogical approach, Ellis, Aharonson, Drori and Shapira (2017) study on the longevity of imprinting on entrepreneurial proclivity concludes that the persistence of imprinting is a consequence of heredity processes. The authors find that lineage inheritance processes shape and enable the transmission of imprinted entrepreneurial knowledge from one generation of founders to the next, hence "single founders might have a 'ripple effect' through which their knowledge and values are perpetuated and influence an entire industrial sector" (p. 501). Interestingly, Simsek et al (2015) note the imprinting influence of individuals and founders is not limited to the founding period but this influence can be experienced at later periods in the organization's development.

Van Driel and Dolfsma (2010) present a slightly different framing of the conditions influencing imprinting and emphasize ‘values and philosophies’ which they conceptualize as an abstract routine. The authors claim “higher-order routines are of special interest since they both modify existing routines and guide the search for and selection of new routines (Nelson and Winter, 1982, p. 18) ...thus, open up the possibility of explaining dynamics and change” (van Driel and Dolfsma, 2010: 37). The authors are of the view that high-order routines represent meta-routines which need not be recognized or formalized implicitly or explicitly in organizations.

The third key feature of the imprinting concept relates to the persistence or “stickiness” of imprints over time despite major changes in the organization’s environment (Simsek et al, 2015). Johnson (2007) refers to this as a reproduction whereby founding structures and practices continue to be exhibited in the organization’s subsequent history. Stinchcombe (as cited in Marquis and Tilcsik, 2013) suggests the persistence of structures and practices may be due to efficiency, inertial forces and interests preserving the structure, and the lack of a competitive environment challenging the organization’s survival, thereby necessitating the need for change. In referring to the nature of imprints and their persistence over time Marquis and Tilcsik (2013) and Wollin (1999) posit that imprints within an organization may be layered over time, but note questions remain as to whether older imprints decay or continue to persist, and what influence do older imprints have on subsequent ones. However, Simsek et al (2015) develop the concept of persistence further and refer to imprints becoming progressively ingrained and amplified in an organization; noting that concepts such as path dependency (Sydow, Schreyögg and Koch, 2009) and self-reinforcement by means of an escalation of commitment (Schreyögg and Sydow, 2011) provide examples of mechanisms explaining the amplification and reinforcement of imprints. In a similar vein Blombäck, Brunninge and Melander (2013) study draws on the work of Schein (1983) to emphasize the retention and reinforcement of imprints. The authors highlight the role of corporate values and value statements in imprinting values on an organization by its founder as a self-reinforcing process (Sydow and Schreyögg, 2013). Whilst acknowledging that some imprints are perpetuated and remain unchanged over time, Simsek et al (2015) contend that the “effects and surface characteristics can vary over time” and therefore “imprints are subject to change, evolution, and transformation” (p. 299), a process the authors refer to as metamorphosis.

Conversely, a contrary view to the persistence of imprints exists purporting that imprints can also decay over time, with studies referring to mechanisms such as organizational change and inertia (Marquis and Tilcsik, 2013) as contributing to the imprint decay. Simsek et al (2015) propose that other than persisting, decaying, and becoming ingrained, imprints may also assume a fourth state – transformation – whereby an imprint is “subject to abrupt destruction or transformation” (p. 301), be it through, for example, incremental or radical transformations, or punctuated equilibrium (Wollin, 1999). However, gaps remain in our understanding of the mechanisms underpinning the creation, and retention of imprints (Blombäck et al, 2013; Johnson, 2007). Furthermore, imprinting studies have generally paid little attention to the interaction and interplay between the mechanisms and forces that produce the persistence, amplification, transformation and decay of imprints (Simsek et al, 2015).

### **Strategic change and the role of crises**

In extending the imprinting hypothesis, this paper follows in the same suit of studies acknowledging that the occurrence of crises events represent sensitive periods in an organization’s development (Dieleman, 2010; Narayanan, Colwell and Douglas, 2009).

Management literature is rife with studies examining corporate scandals, disaster events, and the strategies with which to manage and respond to these crisis events (e.g. James, Wooten and Dushek, 2011). Prevailing discourse on organizational change posits that crisis events provide an apt platform upon which to instigate organizational change, and this thinking has become a key component of planned change models in management and strategy research. For example, Lewin’s (1951) seminal work develops the three-step model of planned change – unfreezing, ‘moving’ (change), and refreezing. The model contends that for change to occur, the organization must be shaken-up and its stability disrupted. Similarly, Schein (1996) recognizes the importance of destabilizing an organization from its status quo in order to produce change. Common across these change strategies is the notion of creating a sense of urgency, ‘a burning platform’ or crisis as a trigger to initiate change. However, what form the crisis or burning platform should take is not explicated, nor does

literature provide insights into the unplanned and unintended effects that may arise as a result of creating a sense of crisis; and importantly, how does an organization's historical experience of crisis and urgency influence future change initiatives?

Moreover, Seeger, Ulmer, Novak and Sellnow's (2005) case analysis of bond-trading firm Cantor Fitzgerald and their discourse around change and renewal post the USA 9/11 terrorist attack found evidence supporting the view that crisis is a change-inducing platform "with the potential to fundamentally alter the form, structure, and direction of an organization" (p. 78). However, the authors recognize a dichotomy that exists with crisis events for they can induce severe harm in addition to change.

As a field, crisis management literature is fragmented and interdisciplinary (Sarkar and Osiyevskyy, 2017). Debate surrounding crises and organizational change orientate around two perspectives. One perspective shares the view of planned change models and contends that crises are change-inducing platforms promoting organizational adaptation or renewal (Seeger, et al, 2005). The second perspective frames crises negatively, maintaining that threatened organizations are defiant, resist change, exhibit risk-averse behaviors and hold to pre-existing established ways (Sarkar and Osiyevskyy, 2017). Much of the existing crisis management research assumes this second view and frames the phenomena negatively, viewing it as a disruptive threat or problem to be overcome (James et al, 2011).

Organizational crises have been depicted in extant literature along various lines. A phrase commonly used in literature to define crisis describes it as a 'low-probability, high impact situation' (e.g. Carmeli and Schaubroeck, 2008: 177; Yu, Sengul and Lester; 2008: 452). Seeger, Sellnow and Ulmer (1998) focus on uncertainty and the unpredictable nature of crises, describing it as "specific, unexpected and non-routine, organizationally-based event or series of events which create high levels of uncertainty and threat or perceived threat to an organization's high priority goals" (p. 233). James and Wooten (2010) emphasize the public, sporadic and undesirable quality of crises which "requires immediate corrective action by firm leaders" (p. 17). Dutton (1986) also considers the need for corrective action as a defining feature of crises describing it as "a perception that an individual or set of individuals face a potentially negative outcome unless some type of corrective action is taken" (p. 502). In defining the term 'crisis', Fink, Beak and Taddeo (1971) regard it as a specific event which induces change: "Most often a crisis is precipitated by an identifiable event, either within or outside the system, and the processes of coping and resolution are relatively

long-term in nature. The extent or intensity of the crisis depends primarily upon the degree of change required of the system in order for it to adapt successfully” (p. 17). Literature recognizes that crisis events are not all the same and differ in their origin, magnitude, and resulting impact. Nevertheless, studies to date are dominated by the view of crisis as an extreme event triggered by exogenous environmental shocks (i.e. national or global economic downturns, political instability, and terrorist activity (Mainiero and Gibson, 2003; Schmitt, Probst and Tushman, 2010).

Some studies have shown crises can result from endogenous factors unattended to by managers (Roux-Dufont, 2009), or vulnerabilities at different levels of the organization (Pauchant and Mitroff, 1992). Roux-Dufont (2009) processual exposition of crises provides an alternative conceptual perspective. Roux-Dufont (2009) views crises not as sudden unusual occurrences independent of managerial competence, but the product of two parallel cumulative processes internal to an organization which cultivates organizational vulnerabilities revealed by a precipitating event. The author contends that these processes represent pre-existing conditions that make the organization susceptible and prone to crises. The first process relates to deficiencies that build up within an organization and form the basis upon which crises occur. The other process is associated with the lack of knowledge managers have of these organizational deficiencies and as a consequence of managerial ignorance, defects accumulate making the organization vulnerable. In another vein, Fink, Beak and Taddeo (1971) conceptual framework disaggregates the four phases of crisis as it pertains to individuals and is extrapolated to organization's – 1) shock, 2) defensive retreat and resistance to change, 3) acknowledgment, and 4) process of adaptation and change. Fink et al's (1971) four stage model assumes all crisis events follow an organized discernable pattern and move through each of the four stages sequentially through time. The authors propose that present within every human system is two counterbalancing shifting forces, one which strives to maintain the status quo whilst the other presses for growth and change. They contend that the force to maintain the status quo is dominant during the initial stages of a crisis and manifests in resistance to change, but this shifts towards growth in the latter phases as the impetus for change and adaptation develops. And as the organization begins to make structural changes and adapt, “the systems become less and less dependent upon its past history and more and more in touch with current developments” (Fink et al, 1971: 25). Hence, this view suggests that in a crisis situation organizational imprints embedded in an

organization's history may undergo a transformation or even decay as part of enabling the manifestation of current change.

This paper acknowledges the view of crises as an unforeseen event at a particular time that can be caused by either exogenous or endogenous factors which disrupts the organization, triggers uncertainty and necessitates a change response by the affected organization (James and Wooten, 2010; Sarkar and Osiyevskyy, 2017).

### **Organizational trauma**

Although research attention has been given to the concept of organizational crises, change management models give little attention to the related concept of organizational trauma. The term crisis is broad and captures various characteristics. Simsek et al (2015) contend that imprinting scholars have tended to treat crisis as open-ended phase with little specification as to the nature of the crisis, and note there is a lack of clarity over the "detailed temporal sensitivities and sequences of imprinting" (p. 307). This study emphasizes crisis in relation to organizational trauma.

Organizations experience trauma in a form parallel to individuals (Horman and Vivan, 2005). For organizations, trauma events can involve mergers and acquisitions, down-sizing, restructuring and lay-offs, an economic crisis, or can be a symptom of a crisis or disastrous event (Amabile and Conti, 1999; Simuth, 2017; Stuart, 1996). What is significant is that not all crisis events result in trauma but those that do are defined by this trait.

In defining trauma, Stuart (1996) distinguishes it from abuse and catastrophe, and provides a psychology orientated description of its nature viewing it as "a psychological emergency, a reaction to events that we have intimately and forcefully experienced as overwhelming and which we have little or no control over, no matter how hard we try. Traumatic events bring disruption and uncertainty ... The more intense our perception and experience of the event, the greater may be our trauma. Although there are degrees of trauma, varying from mild to severe, all by definition are traumatic" (p. 12). Simuth (2017) takes a broader view in defining organizational trauma as "a consequence of a situation which causes traumatic experiences to individuals within the organization" (p. 120).



Stuart (1996) purports that trauma is an emotional response to major organizational change and is equivalent to “emotional hiccups” (p. 11), and this assertion is gaining traction in organizational management and behavior literature (Szymanski and Schindler, 2017). Prevailing assumptions of organizational trauma associate it as having a negative influence on an organization’s performance and behavior. However, Szymanski and Schindler (2017) illustrate that organizational trauma can also have a positive long-term effect on culture “when consciously reflected upon” and can be turned “into positive reinforcements of organizational culture and an impetus for change” when directed by highly skilled managers (p. 1536). Hence, one could argue that crisis-trauma events are paradoxical for they provide a fitting springboard from which to launch radical planned organizational change in an effort to produce positive performance outcomes; but simultaneously it can also be the source of internal injury to an organization and its employees, and interfere with performance. Organizational trauma represents a significant phenomenon borne out of negative circumstances whose effects reverberate across an organization’s culture, performance and behavior over time (Szymanski and Schindler, 2017). Horman and Vivan (2005) and Kahn (2003) both highlight that organizational trauma arises from internal or external acts, can be direct or indirect, and assume many forms. Drawing on Lewin and Schein’s change models, Szymanski and Schindler (2017) propose that sudden traumatic events produce “a significant emotional loading” effect on the organization, creating a platform to disrupt the status quo and provides managers an opportunity to introduce new positive changes.

In characterizing trauma events, Mias deKlerk (2007) notes its compounded effect, given that traumatic crisis events can occur periodically throughout an organization’s lifecycle. Mias deKlerk (2007) explains that “traumatic events also do not stand alone, but rather have a cumulative effect where the trauma of an incident adds to and builds upon previous trauma” (p: 50). This assertion suggests that in order to understand, crisis and trauma events and their effects, research should not focus on a solo crisis-trauma event, as is traditionally done in articles, but rather look at the cumulative experience of trauma events an organization undergoes to understand how they link and build upon each other, and the impact this has on the organization. Keidl (1994) views trauma as a psychiatric condition which produces a distressing emotional experience with long-lasting effects and, in a similar vein to Mias deKlerk (2007), questions whether trauma could in the long-run negate any perceived successes

gained from restructuring. Keidl (1994) queries the long-term effects of trauma suggesting a forward-looking perspective is required to understand how trauma experienced by organizations today could affect them in the future. Whereas Keidl (1994) advocates for a forward-looking approach to analyzing current trauma events to ascertain the future, this paper takes a converse position and asks how an organization's contemporary strategic orientation and change initiative is affected by historical crisis-trauma events in its past. As such, the study sets out to analyze the organization's present strategic change towards exploration and exploitation by understanding its history looking at the present phenomenon using a retrospective frame of history (Garland, 2014). Thus, in exploring markedly pertinent aspects of an organization's past set in a distinctive time-period (i.e. historical crisis-trauma events), the study looks to understand the imprints created by such episodes upon an organization and how they are embodied and manifest in its current strategic process.

In summary, literature highlights that an organization and its functional context is shaped by its history. In seeking to understand how organizational history influences an organization's contemporary transition to a new ambidextrous strategy (the dual pursuit of exploration and exploitation) this study draws on the imprinting concept. Imprinting literature explains defining organizational characteristics are established during sensitive periods in an organization's history, with studies giving primacy to an organization's founding. Furthermore, post-founding sensitive periods have gained recognition as periods during which the imprinting process occurs and imprints are (re)established. This study gives particular attention to historical crisis events post an organization's founding, as a sensitive period during which organizational imprints may be created or transformed. The study does not take a broad view of crises but gives particular attention to endogenous events where the nature of crisis is characterized by organizational trauma and induces significant emotional response. Studies reflect that organizational history can enable change as well as be a constraining force, and in the same vein researchers contend that organizational crisis and trauma events can provide a platform for change whilst other researchers frame it as having a negative effect on an organization. Thus, in engaging with the concepts of organizational history, imprinting, crisis and trauma this study investigates what influence these historically embedded concepts have on an organization's contemporary strategic change effort for ambidexterity. Figure 8 represents a conceptual framing of the related key concepts pertinent to this study.

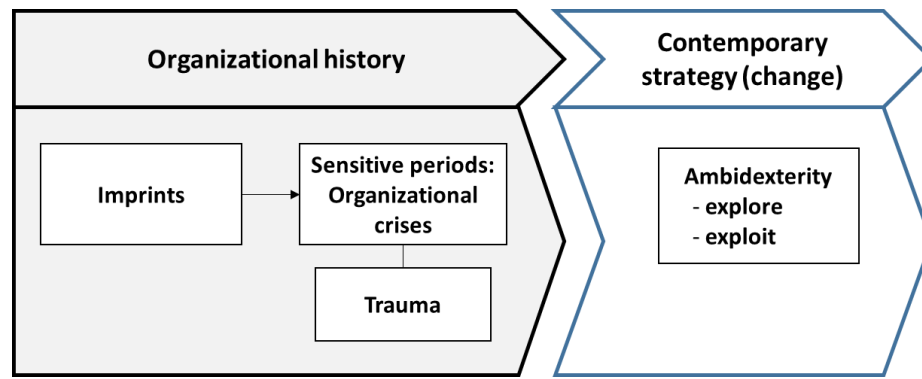


Figure 8: Conceptual framing of key concepts

## METHODS

### Research design

This study is based on an in-depth single case analysis utilizing longitudinal data of the NASA Johnson Space Center (JSC) and critical events in its history from its founding in 1958 to 2015. The research approach follows in the footsteps of qualitative longitudinal single-case studies underpinned by the intention to develop theory of strategy as a practice (e.g. Carter and McKinlay, 2013; Paroutis, Mckeown and Collinson, 2013).

### Research context – The NASA Johnson Space Center

The NASA Johnson Space Center (JSC) was selected because as an established organization it has a well-documented, long history that is characterized by highly publicized historical achievements and crisis-trauma events. An important distinguishing feature of NASA and JSC is its organizational history (see appendix E for further details of JSC founding history). As a Center, JSC is historically accustomed to undergoing change, from changing government Administrations and Center Directors to space mission programs. JSC's history is distinguished by a number of significant exogenous and internally provoked events, including crises and fatal disasters - the Apollo 1 fire, Space Shuttle Challenger and Space Shuttle Columbia disasters (see table 10). The fatal crisis events led to Congressional hearings and attracted mass media news reporting and public reactions. More recently, in 2010, under what was a new government Administration, the relatively new Constellation

space program directed out of JSC, was cancelled for being untenable due to escalating budget costs and delays in its schedule, ending five years of federal investment amounting to \$9 billion and one of the Center's largest programs. The following year, 2011, marked another defining moment for JSC with the retirement of the Space Shuttle vehicles, ending the 39 years program operated out of JSC. It was the last time JSC would control and be responsible for the launch of a human space vehicle. The cancellation of the Constellation program and the end of the Shuttle program had a massive impact on JSC who saw the end of two space missions within the space of two years, the loss of more than 5000 jobs (contractor employees) and a decline in morale; "to people who are working on these programs, this is like a death in the family" (NASA Administrator, Charlie Bolden). As of 2017, the Space Station is now the only operational human space vehicle with JSC mission control handling most of the day-to-day operations on board the ISS.

Furthermore, since 2012/2013, JSC's senior management developed a new internal strategy designed to reposition the Center and better align it with its changing context. For JSC, organizational performance and environmental variation (Boeker, 1989) are the relevant factors provoking the organization to change and adopt a new strategic direction geared towards ambidexterity. Changes to its space programs, radical variation in its external environment and decreasing budget appropriations (appendix F), means the organization finds itself in a new environment characterized by an unprecedented degree of change. In redesigning how the organization operated internally, Center management devised and set about pursuing a Center wide ambidextrous strategy. The new strategy was labelled 'JSC 2.0' and aimed to foster exploration capabilities by furthering innovation in human space exploration research and engage in collaborative partnerships with commercial organizations in non-aerospace industries (i.e. Oil and Gas, Medical); whilst at the same time ensuring the Center continued to exploit its expertise and executed its main tasks effectively<sup>27</sup>. JSC sought to utilize its existing knowledge and expertise and develop new knowledge, technologies and capabilities from their commercial collaborators. However, the new strategy challenged JSC for it signified a degree of contrast to its historical way of

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<sup>27</sup> Since its inception, JSC has had four primary manned spaceflight tasks: space development; mission control; research and development; and astronaut selection and training. (Source: JSC Historical Narrative; "Gilruth Cites MSC Progress Despite Difficult Relocation." Space News Roundup (1, 19), July 11, 1962, 1).

operating. Hence, JSC is a suitable case organization to explore the role of history, past-crisis events and their manifested effect on an organization's strategic pursuit for ambidexterity.

### **Data collection**

The initial intention for this research study was to understand how JSC and its members comprehended the Center's new strategic orientation towards ambidexterity and the approach it enacts to achieve this. In the course of conducting the research it became increasingly apparent, through data analysis, that the organization's history significantly influences its strategic approach and required further investigating. The research drew upon multiple primary and secondary sources of data including interviews with organizational actors, onsite-observations of internal meetings and Center-wide events, the organization's intranet, publicly available resources published by NASA and mainstream news media (i.e. books, reports, weblogs, and video documentaries), and written documents accessed from the JSC archives. This multimethod approach provided the opportunity to engage with various resources, thus allowing me to observe and capture organizational dynamics, tensions and features influencing the organization and its approach to achieving organizational ambidexterity.

The primary data collection portion of the study began in August 2014, approximately a year after JSC Center director announced the new strategic vision for the Center, 'JC 2.0', and was completed in September 2015. In total four onsite research visits were made during the study and on each occasion the researcher was immersed in the culture of the organization and learnt the technical vernacular commonly used by its members<sup>28</sup>. This relatively extensive time period meant I was able to capture data on the organization's strategic change process and its implementation as it was occurring. Visits onsite at JSC lasted approximately four weeks and occurred at roughly trimonthly intervals. Observations were conducted during on-site visits where copious notes were taken of everyday activities and interactions, meetings, workshops, and corporate events. A total of 82 in-depth semi-structured interviews were conducted with a diverse array of employees and former employees. Interviews with JSC employees started with informants who had attended

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<sup>28</sup> Refer to 'Methodological Overview' in chapter one for details of the four phases of data collection during this research project.

an internal JSC cultural workshop in August 2014. Interviews were initially broad in terms of questions to provide a wide scope in understanding the Center's internal context and perceived dynamics as experienced by organizational actors. In conducting first hand interviews with actors I was able to capture personal experiences and histories of working at JSC, both past and present, as well as their views of the changes being experienced at the organization, which helped to emphasize and deepen my grasp of everyday life and operations at the organization. As interviews progressed and trends were identified the questions became more tailored in their focus, particularly in the case of certain individuals who by virtue of their hierarchical position in the organization could provide a unique point of view, and so followed a purposive sampling approach (Lincoln and Guba, 1985).

Throughout the study follow-up interviews, conversations and email correspondence occurred with informants. The semi structured interview approach allowed for cross comparison across interview responses and helped strengthen my understanding of actor perceptions and experiences of the strategic change, the influencing forces and systems involved as well as the challenges to the change.

Secondary data collection occurred before, during and after the onsite field visits to further my understanding of JSC, NASA as an Agency and its development over time. Secondary data included press releases, case studies focused on NASA/JSC, media articles, published books, industry reports, news videos and relevant documentaries all concentrated on NASA/JSC and the evolving space program. During the second, third and fourth field visits to JSC one week was spent examining JSC specific archival resources located at the University of Houston. This involved gathering digital and printed archival data from the JSC archives including historical program plans, strategy documents, interview transcripts of former employees, third party contracts and contractor reports, communication documents, and news articles dating back to JSC's early founding years. Initially, the search criteria for archival sources was broad and mainly focused primarily on the major space programs in JSC's history, understanding how they operated and managerial communications at the time. However, during the course of data collection and early data analysis it became apparent that the organization's history, particularly certain historical crisis events, were critical influencers shaping JSC's existing operating mindset and approach to change, and therefore would require further investigating.

<b>Timeline of JSC Key Historical Events</b>	
1958	Founding of U.S. National Aeronautics Space Agency (NASA) Founding of the Space Task Group (STG), the U.S. manned spaceflight unit at Langley, Virginia. (STG predecessor to Manned Spaceflight Center (MSC))
1961	President John F. Kennedy announces U.S. to land man on the moon Apollo program commences: Astronaut Alan Shepherd first American in space STG transformed into Manned Spacecraft Center (MSC) established in Houston (Texas)
1962	Mercury project - Astronaut John Glenn first American to orbit Earth
1964	First American Gemini flight (unpiloted test)
1965	First operational Gemini mission- <i>Gemini III</i> . Commanded by astronaut Gus Grissom
** 1967	Apollo 1 fire. Astronauts Gus Grissom, Ed White, and Roger Chaffee died. (First deaths directly attributable to the U.S. space program).
1968	Apollo program returns to flight. Apollo 8 first manned space mission
1969	Apollo 11, first lunar landing mission. Neil Armstrong walks on moon
1970	Apollo 13 near disaster "NASA's finest hour"
1973	Manned Spacecraft Center (MSC) renamed the Lyndon B. Johnson Space Center (JSC) Skylab vehicle launched: U.S. first orbiting space station
1975	Apollo-Soyuz Test Project (first international human space flight, American Apollo-Soviet Soyuz)
1977	First Space Shuttle orbiter, Enterprise, flight tests
1981	First Space Shuttle (STS) launch, Columbia
** 1986	Space Shuttle (STS) Challenger disaster (7-man crew killed)
1988	First multinational space station agreement signed
** 2003	STS Columbia Shuttle disaster (7-man crew killed)
2004	New Constellation Program proposed
2010	Cancellation of Constellation Program
2010	Commercial Crew Development program
2011	Completion of ISS assembly
2011	Retirement of Shuttle program

*\*\* Major crisis events in JSC history (platforms for organizational change)*

Table 10: Timeline of Significant Events in JSC History

Historical crisis events in JSC’s history subsequently became a line of questioning during primary interviews and directed the search criteria during secondary data collection at the JSC archives and in sourcing publically available documents and media. Subsequent archived items were selected based on whether

they contained evidence of how strategy was implemented at that time period; spoke of historical operational issues and whether they were overcome; conveyed the organization's cultural expectations and perceptions or demonstrated formal operating processes and procedures. In all, approximately 132 archived items were gathered. In sourcing historical and archival data the origin of the source, its authorship, time of production, purpose and context in which it was created was verified which helped to validate reliability and trustworthiness of the sources (Kipping, Wadhawani, and Bucheli, 2014b). These archives helped to provide insights into the organization's inner context and its evolution over time (Pettigrew, 1990).

### **Data analysis**

In analyzing and coding the data I followed an inductive, qualitative approach which allowed me to derive insights from the multivariate sources gathered during data collection. By continually comparing and contrasting the data during each of the four phases of data collection, insights emerging from the findings during each phase fed into subsequent phases of data collection and analysis (Strauss and Corbin, 1990). Analysis of the data evolved through two parallel processes in a vein similar to the work of Kreiner, Hollensbe, Sheep, Smith, and Kataria (2015). In one stream, analysis focused on secondary data sources from publically available media (text, audio and videos), reports, books and historical archival sources. Analysis of these data sources involved writing research notes and memos, logging statements and quotes from video and audio files and categorizing these into broad themes. Focus was given to data relating to historical events and incidences in JSC's past and their associated effect on the organization's ways of working, organizational changes and the documented perceptions of members who lived and directly experienced the events at the time (i.e. oral histories). As the study progressed these themes and categories would be adjusted and refined to help develop theoretical constructs and key findings. I employed event history analysis to build a longitudinal, qualitative understanding of significant events in JSC's history, giving particular attention to major crisis events in the organization's past (see table 9). In the context of this study, historical texts and sources were viewed with a broader understanding (Kipping, Wadhawani and Bucheli, 2014). That is to say that the criteria for what constitutes an historical source was broad in terms of time period and scope, covering the period from the organization's founding (in 1958) through to recent times, up until 2015. I also employed a



hermeneutic interpretation when analyzing the historical sources which served to assess historical bias (Kipping, et al, 2014).

The parallel process focused chiefly on analyzing primary data sources and involved coding interview transcripts, internal documents and memos. Employing Strauss and Corbin's (1990) approach to analyzing data, firstly, interview transcripts (both primary data and secondary data transcripts) and associated notes were coded, with lines of text being assigned a particular code. Codes were inductively derived from interviews and included in-vivo coding using informants own vernacular (Strauss and Corbin, 1998). The codes were continuously probed, compared and adjusted as data collection developed and initial themes and ideas emerging from the data was noted by the researcher in a journal. Following this, codes were sorted into categories and subthemes based on related properties (Walker and Myrick, 2006). These were mapped to field notes, memos and statements logged from analysis of secondary data sources. This allowed me to develop a more holistic understanding of the organization and informant accounts. I also engaged with existing literature which provided a theoretical lens helping to interpret and abstract the data from codes to higher-level constructs. Data management and analysis was managed using NVivo 10 qualitative data software program.

In the case of this research project, the two parallel processes employed for analysis were not treated independently but used integratively as part of an iterative process where the codes and insights from one process fed into the analytical process of the other. Triangulation of primary and secondary sources and historical sources aided in supporting trustworthiness of the data (Kipping et al, 2014).

As data collection and analysis progressed recurring themes and categories emerged of the organization's history, its influence on the strategic change to ambidexterity and the operating tensions this bore. To check the accuracy and validity of the emerging themes and constructs, the findings were presented to informants and managers at JSC who were interested in research outcomes intermittently throughout data collection, and also at the end of the research study (i.e. in June 2017 during a final presentation where all key findings from the completed research project was fed back to organizational members). Furthermore, immersing myself into the organization's culture and style of speaking helped to reinforce my depth of understanding of organization and served to strengthen trustworthiness of the codes, emerging themes and interpretation of the data. Table 11 depicts the themes and

illustrative quotes from interview informants (which includes time tags indicating the data collection phase it occurred) and secondary sources. Figure 9 summarizes the emergent data structure (Gioia, Corley, and Hamilton, 2012) upon which analytic discussion of the findings is based.

## **ANALYSIS AND FINDINGS**

The findings show that an organization's history and its influence on an organization's contemporary strategic activity is multidimensional. The paper identifies three main dimensions, each of which are historically embedded – (1) sustained founding imprints, (2) sensitive periods of crises, and (3) reprinting organizational characteristics. Analytically, each of these dimensions represents a distinct process or period but are also interrelated. The study identifies the occurrence of the reprinting process as a consequence of post-founding sensitive periods of crisis trauma events, and finds this process simultaneously enables and constrains future change.

Furthermore, the study finds that sustained imprinting and the reprinting process manifest as dual processes that occur independently but have an interactive influence and contribute to defining the organization's contemporary perception and approach to ambidextrous activities of exploration and exploitation. The following firstly discusses the three core historically embedded dimensions central to understanding the influence of organizational history on contemporary strategic activities. It then examines how the combined influence of these dimensions impacts the organization's implementation of an exploration-exploitation strategy.

### **1. Sustained founding imprints**

The term sustained founding imprints represents persistent imprinted characteristics – structural systems and method of behaving - that remained stable and are perpetuated throughout the organization's development despite internal (or external) changes experienced by JSC (Marquis and Tilcsik, 2013). As such, this concept reflects the imprinting concept reported in literature, but it goes beyond the

mere persistence of imprinted characteristics and speaks of imprints becoming deeply ingrained and increasingly ‘amplified’ within the organization (Simsek et al, 2015: 300). The study finds that what sustains and amplifies these imprints is a strong association to historical achievements and its historical expert identity.

Analysis found that structural elements established at NASA’s founding in the 1950s continued to persist and have a determining effect on the organization’s contemporary environment and manner of behaving. The founding period is a defining time in the organization’s development during which time certain characteristics, influenced by external conditions at the time, are formed (Johnson, 2007) and continue to influence the organization’s contemporary behavior and structure. The study found certain imprints originating at NASA founding in 1958 and JSC’s establishment in 1961 remained relatively stable until the contemporary period (2014-2015), post JSC’s announcement to implement a new strategic vision aimed at pursuing efficiency and innovation, collaborating with entities in commercial space.

Two organizational features in particular, originating from the organization’s founding, were found to have persisted in influencing JSC in its present context. (1) Militaristic method of operating, (2) Stovepipe structural systems. The data found that these features were perpetuated by a third factor, historical achievements.

#### **a) Method of operating**

##### **Cold war context and a militaristic method of operating**

**Founding:** JSC was established in 1961, during the height of the Cold War when geopolitical tensions between the Soviet Union and the U.S.A saw both blocs compete for space leadership. For NASA and the human space flight program, the Cold War context of the 1950s-1960s was a key feature shaping the Agency’s founding and defined the purpose of NASA, its structures and culture. NASA and JSC was birthed in trepid but competitive reaction to the launch of Russia’s Sputnik, the first artificial satellite in space.

“The Soviet satellite supplied an opportunity for the USSR to claim that it has opened a new era, marked by a spectacular overtaking of the U.S. in a vital field where we have been accustomed to count on superiority, and now

compete with the U.S. as an equal” (White House Office, 1957)<sup>29</sup>

Research found the launch of Soviet satellites (Sputnik I and Sputnik II) and the competitive geopolitical environment at the time is critical to understanding the motivation for NASA and JSC, its set up and way of operating. Before NASA’s founding, the US military was the major player in space activities, establishing priorities and initial operating standards for space: “Prior to NASA the military had had the upper hand in determining all space priorities, and civilian interests when considered at all, were clearly secondary. There were also multiple military space actors - primarily the Air Force and the Army” (Day, 1996). The creation of NASA in 1958 shifted the control of the space science from the military to a civilian workforce, however the militaristic foundations of the space program and the cold war climate were absorbed into the new organization. Hence, the operations, processes and ways of behaving characterizing the then new NASA Agency was imprinted by the environment of the time:

“The birth of NASA must be placed in the context of its times [...] NASA’s birth was directly related to the launch of the Sputniks and the ensuing race to demonstrate technological superiority in space. NASA’s birth was directly related to the launch of the Sputniks and the ensuing race to demonstrate technological superiority in space. Driven by the competition of the Cold War [...] NASA began by absorbing the earlier National Advisory Committee for Aeronautics (NACA), including its 8,000 employees, an annual budget of \$100 million, three major research laboratories ... It quickly incorporated other organizations (or parts of them), notably the space science group of the Naval Research Laboratory that formed the core of the new Goddard Space Flight Center in Greenbelt, Md., the Jet Propulsion Laboratory managed by the California Institute of Technology for the Army, and the Army Ballistic Missile Agency in Huntsville, Ala., where Wernher von Braun’s team of engineers was developing large rockets.” (NASA Chief Historian, 2008).

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<sup>29</sup> Reaction to the Soviet Satellite - A Preliminary Evaluation. October 16, 1957 [White House Office of the Staff Research Group, Box 35, Special Projects: Sputnik, Missiles and Related Matters; NAID #12082706]

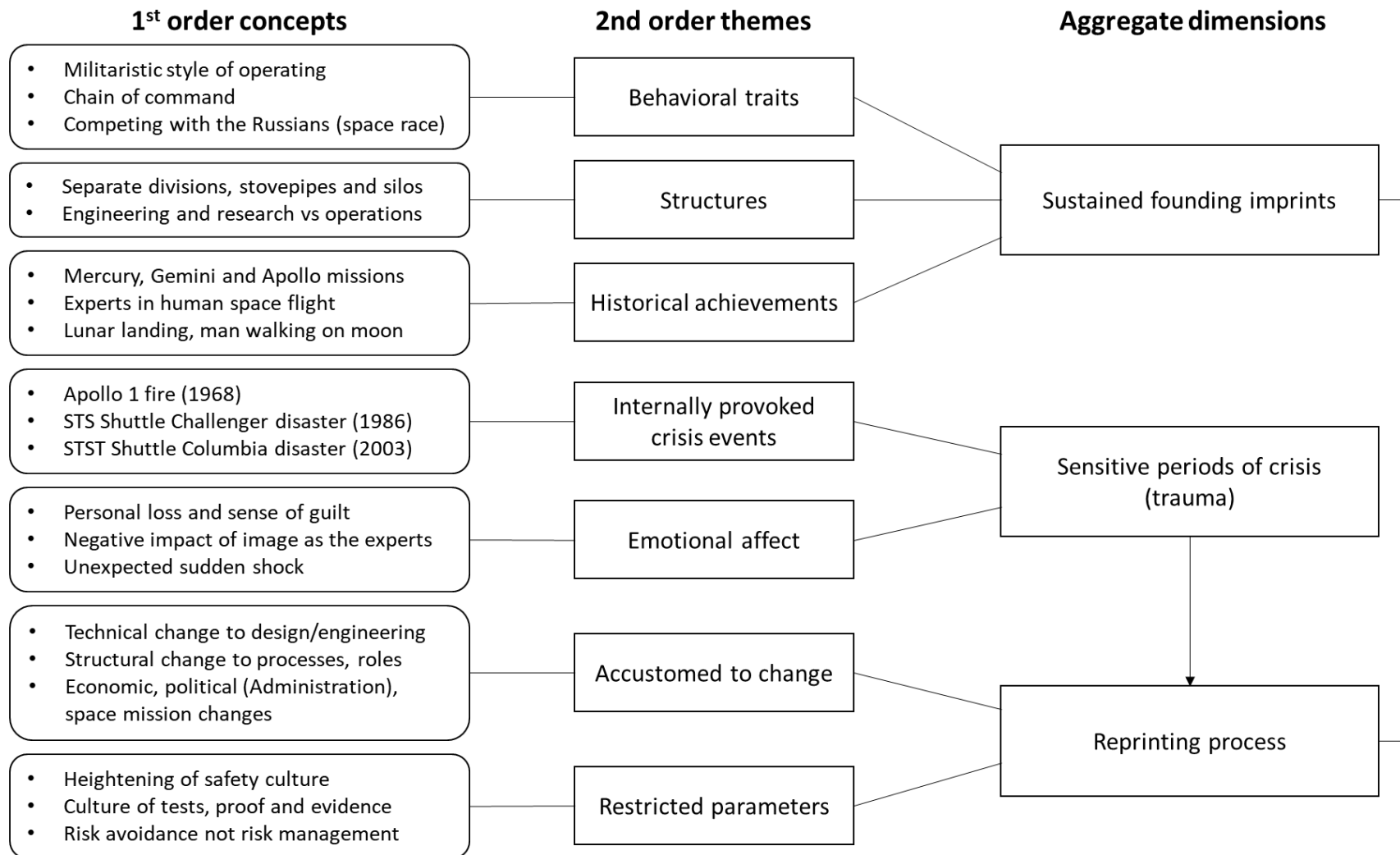


Figure 9: Data Structure

**Behavioral traits**

*Historical:* “when I first started here [in the 1970s], I would say that the mindset-- because there were number of the people that were the leaders of the organization were all ex-military - the mindset was very - I never say it – militaristic... it was very regimented, protocol, chain of command” (Interviewee, Division Head)

*Contemporary:* “we at NASA, we're like the military. It started out more of a salute [mentality], and do what as you're told, and salute as before... And I think we've come a long way and part of it is a lot of those folks have retired [chuckles]. No offense to them, but they have retired. And I'd say that the other challenge that we have is not necessarily generational, but just with what's happened with NASA is-- again we had the space race, everybody was behind you, the money was the budget and everything and as time went on” (Interviewee, Senior office manager)

**Structures**

*Historical:* as I moved over and was responsible for the directorate effort on Apollo, it became pretty obvious to me that one of the areas of key weakness in the whole program was that nobody really knew what the other guy was doing in the program. There was an awful lot of specialist groupings going off in their own specialist area, and the program office was trying to keep them coordinated from a program office point of view - - [primarily hardware]” (Archive transcript, Deputy Director, 1966 )

*Contemporary:* “we began finding out that we didn't know what other people were doing in the agency. Incredible work. Pockets of people who were absolutely world-class in what they were doing, but not integrated with anything anybody else was doing... Imagine being in a meeting and saying, "Well, we need this critical piece of hardware, technology, and we'll have to go out and do a technology research program, or go out and canvass and see who can do this." And you don't know it, but the guy in the building next to you is actually doing that or something very close to it. That happened more often than I would have believed...” (Interviewee, former JSC employee)

**Historical Achievements**

“if you look at the '50s and '60s, NASA was really pushing the technology in a lot of areas, and if NASA didn't push the technologies that we needed to get into space, not just with humans, but with telecom and other things, it wouldn't have been there for other companies to come in and build the GPS satellites that now make yourself cellphone and credit cards work. But I question whether in all areas NASA's really leading the technology today” (Interviewee, office manager)

<b>Internally provoked crisis events</b>
The cause of the Columbia accident was twofold. The physical cause resulted from the loss of insulating foam from the External Tank...NASA's flawed culture of complacency also bore responsibility for the loss of the vehicle and its astronauts (NASA Historian, Historical legacy, 2010)
"The middle of winter is a somber time of year for the spaceflight community. The three worst tragedies of NASA's manned space program fall within just six days on the calendar, from January 27 to February 1: Apollo 1, less than three years before Armstrong and Aldrin walked on the Moon; Challenger, watched live by millions around the world; Columbia—like Challenger before it, an avoidable accident rooted in NASA's internal culture" (Science, press article).
<b>Emotional affect</b>
"I think one things should be said. This is a time for great sadness, national sadness and certainly personal sadness for the people in space program." (CBS News, 1967)
"All of the human spaceflight centers—KSC, MSFC, and JSC—suffered terribly from the loss of Challenger and Columbia. The personnel of all three centers recovered by rededicating themselves to understanding what caused the accidents and how accidents could be prevented in the future. Together, they found the problems and fixed them" (NASA Historical legacy book, 2010)
<b>Accustomed to change</b>
"The other thing that's difficult in that environment is the politics. If you go through a 15-year project build, you're going to go through four, maybe, presidential cycles. Priorities change" (Interviewee, Senior engineer)
"I think the NASA culture [change] is cyclical, the NASA culture is. So if we look at what the agency has done over time, so we'll see things where we're really being driven by schedule, and then we have the Apollo 1 fire, and so we lost three people, and we made some changes...after the Columbia accident, we kept saying we were going to fly within six months, and that meant any changes we needed to make had to be implemented within six months..." (Interviewee, Division Director)
<b>Restricted parameters</b>
<i>Historical:</i> "The prime purpose of all tests conducted prior to launch is to verify and demonstrate that the space vehicle ground support equipment, procedures and personnel are all ready for flight operations. Many of the tests involve a "first time" operation particularly in an overall sense. Therefore, inherent in the verification process is the likelihood that faults will be found in procedures and in equipment" (Apollo 204 review board report, 1967)
<i>Contemporary:</i> "... JSC is about the business of getting things done, failure's not an option, we're going to get the mission accomplished no matter what, and we are going to make sure that there is no chance that whatever system we are working on is actually going to fail. We will take out all potential capacity for that system or vehicle to fail. We are going to remove all doubt. We are going to study it until we can be confident that we are not taking unnecessary risk..." (Interviewee, senior manager)

Table 11: Extracts of first-order codes associated with second-order themes

In incorporating the NACA, its personnel and military related units into NASA, the new Agency was influenced by its relations with the military in its early development: “NASA also inherited projects, programs, people, and installations which had their origin in the military services” (Archive: NASA Historical Staff, 1966:3). Though NASA, a civilian agency, was focused on the development of space sciences, the organization drew upon its deep military association in terms of the way it operated<sup>30</sup>:

“The style of management developed in them [NASA’s early large-scale and high-tech projects Atlas, Mercury and SAGE] propagated cold-war ideals... Systems analysis, systems engineering, project management, and configuration control developed in the military-industrial-academic complex on large aerospace projects, and they continue to thrive. In them the values and institutions of the cold war persist...” (Johnson, 2001: 686)

For example, NASA’s approach to design and production and its reliance on contractors followed the operating model used by the Army and Air Force:

“NASA’s contracting drew on both the Air Force’s heavy reliance on independent contractors for design and delivery and the Army’s traditional arsenal for in-house production and design capability. NASA engineers, at least through the Apollo years, maintained an in-house capability allowing them to keep the design and technical skills to effectively direct, lead, and manage the NASA contractors” (Dethloff, 1993)<sup>31</sup>

**Contemporary.** In describing the modern organizational culture and manner of operating at JSC, interviewees expressed it using militaristic terms, suggesting the founding influence persisted and was still active at JSC:

“It’s very much ‘you don’t know your place’, ‘you need to make sure you’re talking to me about it’. And that’s a lot of the culture here. It’s very militaristic. It’s very....My father was in the military so I was very comfortable

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<sup>30</sup> Much of the work conducted by the NACA related to solving the problems of other organizations/agencies, the most critical relationship being with the U.S Department of Defense (DOD). (NASA History Archive, Beyond the Atmosphere: Early Years of Space Science, 1977; 1966)

<sup>31</sup> Dethloff, H.C. (1993). ‘Suddenly, Tomorrow Came...’ The NASA History Series. NASA: Lyndon B. Johnson Space Center. Library of Congress Catalog Card Number: 93-86012



coming in here. First I was like, okay, who's my next chain in command? Oh, here's your Lead. Who's his chain? There's your Chief. Okay" (Team Lead)

## **b) Structural systems**

### **Stovepipes and silos**

**Founding:** When the National Advisory Committee for Aeronautics (NACA) transitioned to become NASA in 1958, its assets and personnel transferred to the new organization including “the historic tendency of ‘stovepipe’ management” (NASA Archive, 1977). This traditional feature of the military-civilian relationship of the NACA, transferred over to the Manned Space Center when it opened in Houston in 1961. Since the early beginnings of NASA’s space programs there has been a distinction between technical and operational/administrative organizational activities at a management and functional level. This is exemplified in one archive transcript:

“During that period, from July 1961 to 1962, I was, in a sense, co-director of the [Apollo] program with Milt Tregaser. Milt was the technical director, I was the operations director; essentially his job was to solve technical problems and I was to solve the management and organization problems...” (Archive transcript, Deputy Director, 1966)

The data indicates that the technical programmatic activities and organizational management were historically treated as two distinct competencies to be managed separately. This structural differentiation in competencies is reminiscent of structural ambidexterity and its principle of separation.

**Contemporary:** In describing JSC’s modern context interviewees described it as being siloed and stovepiped, separated along various lines. Some interviewees referred to the distinction as being ‘the technical-side’ and ‘the business/non-technical side’, whilst others referred to it as “the institution versus the program” dynamic. The program connoted technical, engineering human space activities whilst the institution referred to the Center’s administration and facilities operations. This dynamic was referred to as being critical to understanding the workings of JSC and its cultural complexity:

“I think it's an important dynamic at Johnson, and probably with every center is the difference between program and institution. You should really look into this as a tool to understand why things are the way they are...” (Interviewee, Office manager)

### **c) Underlying features perpetuating founding imprints**

#### **Association with historical accomplishments:**

The study found that certain organizational characteristics established during JSC's founding were sustained throughout its history because they were perceived to be associated with the accomplishment of significant achievements in the organization's history.

In 1961, when President John F. Kennedy set NASA the goal of placing a man on the moon within a decade, a benchmark for leadership and technological excellence was established for what was the space race.

“I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth. No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish” (President John F. Kennedy, 1961)<sup>32</sup>.

By achieving this ambition in 1969, NASA and the Manned Space Craft Center (became JSC in 1973) achieved what was considered nationally and internationally as “the greatest adventure of all...men had actually reached the moon” (BBC video archives)<sup>33</sup>.

The stovepiped structure and culture established in NASA/JSC's early years was considered a contributory factor to its lunar accomplishments in space during the 1960s and 1970s space programs (i.e. Gemini, Apollo, Saturn programs and man walking on the moon). These NASA successes were associated with the organizational

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<sup>32</sup> President John F. Kennedy (1961) Joint session of Congress speech, May 25.

<sup>33</sup> BBC video archive, The Sky at Night: Looking back to 20 July 1969. Sound and video footage from 1969. Documentary first broadcast 2006

structures and cultural features active at the time period in which they occurred (the 1960s and 1970s). Hence, perpetuating these organizational features reinforced their value and positive contribution to achieving space missions. For example, in referring to NASA's historical achievements and education of these, a former NASA administrator remarked:

“What I found fascinating was the historical research and looking at the record of how NASA was initially organized. It wasn't just assembling a lot of very smart people in a room and saying, “Give this your best shot now that you're all together in the same place.” ... All these decades later, there are still defining cultural features about the Agency based on its “stove pipe” origins that existed well before the NASA “meatball” was ever introduced (Oral history transcript, Former administrator)<sup>34</sup>.

***The expert identity.*** The success stories of NASA's past from the lunar landing to the Apollo 13 recovery; an event dubbed “NASA's finest hour”<sup>35</sup>, imprinted and reinforced JSC with an expert identity and an internal reliance that they were the knowledge center for human spaceflight. A value belief that perpetuated through JSC's history and the various changing space missions:

“You've got an organization that very much values that internal reliance on doing everything, self-inventiveness, based on the premise that there's nobody outside that's doing this, and you get that embedded in the organization. And you find that's been a very successful model, actually. And then you bring that all the way forward through Apollo and Shuttle and the international Space Station, and largely that model remains effective...” (Chief technologist, 2017)<sup>36</sup>

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<sup>34</sup> NASA oral history interview transcript (2014). Former NASA Administrator.

<sup>35</sup> Apollo 13 mission is looked up at JSC as the Center's “the finest hour”. See ‘Apollo 13’ on [www.nasa.gov/missions/Apollo13](http://www.nasa.gov/missions/Apollo13)

<sup>36</sup> Terrier, D., Heracleous, L., and Gonzalez, S. (2017). p. 22

## 2. Post-founding sensitive periods: Crisis and organizational trauma

Findings indicated that crisis events presented sensitive periods in the organization's history during which JSC was susceptible to external and internal influences (Johnson, 2007), which subsequently resulted in important changes. These crises signify traumatic intermural events which had a significant emotional effect on organizational members (Simuth, 2017; Stuart, 1996), and served to reshape certain organizational features. These major crisis events were caused by internal factors rather than external conditions, and consequentially reshaped core structural and cultural characteristics in JSC. The following outlines the major crisis events that occurred at JSC, the origins and organizational trauma effects.

### Historical major JSC events of crises and trauma

#### The Apollo 1 fire

On January 27, 1967 during the early years of NASA's Apollo program a fire occurred in a manned command module (Apollo 204 spacecraft) during a 'plugs-out' test on the launch pad at Cape Canaveral, simulating flight conditions. The 'plugs-out' test was "a routine but necessary part of qualifying the hardware" (Pyle, 2014<sup>37</sup>) and Mission Control who were responsible for monitoring the tests were based in Houston at JSC. The three astronauts on-board the command vehicle all died as a result of the fire. The fire had been caused by a short circuit somewhere in the 30 miles of wire underneath the seat of astronaut Gus Grissom, and the pure oxygen within the command module ignited the fire much faster. The Apollo 1 fire was the first fatal tragedy to befall JSC and NASA's space program. Under the direction of NASA Administrator James Webb, NASA appointed a review Board - the Apollo 204 Review Board - to conduct an internal investigation into the incident.

*Source of the crisis: Technical not managerial fault*

The Apollo 1 review board investigating the cause of fire deemed the incident to be the cause of technical faults with the module's hardware: "The Board's investigation revealed many deficiencies in design and engineering, manufacturing and quality control" (Apollo 204 review board report, 1967). The Board's investigation reviewed in detail the technical issues and found numerous technical deficiencies:

*"...they did in the investigation find numerous problems with the Apollo command module. It had a pure oxygen environment. There were wiring problems which probably produced the spark which set off the blaze. There were flammable materials in the cockpit. Nylon straps, things like that which would have burned very rapidly..." (CBS News, 1967)<sup>38</sup>.*

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<sup>37</sup> Pyle R. (2014), p. 72

<sup>38</sup> Excerpt taken from archive video footage, CBS News special report (1967)

Post the fire, NASA implemented numerous changes in line with the Board's recommendations, which included redesigning a quick- and outward opening hatch. It took the Apollo program almost 18 months to recover from the disaster and return to normal operations. Critically, the Apollo review Board found the fault to be technical and unrelated to management methods or operations: "That investigation [the 1967 hearings] yielded one important 'non-finding'. Congress found no fault with management methods recently implemented by Samuel C. Phillips, the director of Project Apollo." (Johnson, 2001: 685).

#### *Organizational trauma:*

The response of JSC personnel at the time towards the Apollo 1 fire incident was one of disbelief, guilt and sadness and was referred to as "one of the worst tragedies in the history of spaceflight" (NASA Apollo Program, 1967): *"It was a tremendous tragedy...there had never been a fatality in the space program. Everyone knew it was risky but there's theory and then there's reality. The loss of these three astronauts was a major blow. It certainly was shocking to NASA and I think to the public at large... and it really sent shock waves I think through NASA and through the nation. This was something that people were riveted to their television sets to find out what had happened. What had gone wrong and what might it do to the race to the moon"* (Space consultant, 2017)<sup>39</sup>

Days following the Apollo 1 fire, one of the Apollo flight directors gave a speech to the rest of the Apollo program conveying the guilt and blame JSC employees at the time placed on themselves: *"Spaceflight will never tolerate carelessness, incapacity, and neglect. Somewhere, somehow, we screwed up...Whatever it was, we should have caught it. We were too gung ho about the schedule and we locked out all of the problems we saw each day in our work. Every element of the program was in trouble and so were we... I don't know what Thompson's committee will find as the cause, but I know what I find. We are the cause! We were not ready! We did not do our job!"* (Excerpt of speech by Apollo 1 flight director, 1967)

### **STS Challenger Shuttle disaster**

On 28 January, 1986, nineteen years after the Apollo 1 fire, the Challenger space shuttle prepared for its 10th launch from Kennedy Space Center (KSC) in Cape Canaveral, Florida. In the run up to the launch the weather temperature had been uncharacteristically cold in Florida which caused the launch date to be moved back a number of times. On the morning of January 28 the weather dropped below freezing, raising concern among some NASA personnel and contractors over the integrity of the O-ring seals on the solid rocket boosters in the unusually cold weather. At 11: 39AM (EST), 73 seconds into the launch flight the Challenger space shuttle exploded, disintegrating over the Atlantic Ocean off the coast of Florida. All seven crew members died including Christa McAuliffe, the first teacher selected to be a part of the "Teach in Space" project. President Reagan appointed the Rogers Commission to investigate the accident. It took 32-months before the Shuttle program flew again in 1988.

#### *Source of the crisis: Technical and managerial-cultural systems failings*

The presidential commission assembled to investigate the Challenger shuttle explosion identified technical and managerial causes of the accident. Technically, the Commission concluded that there was a design fault with the O-ring seals on the rocket

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<sup>39</sup> Excerpt recorded from news media video footage, CBS News (26 January, 2017)

boosters. The O-ring seals had degraded in the extreme cold weather which compromised the performance. Managerially, the Rogers Commission Report identified numerous failings which stemmed from the organizational culture. Cultural issues focused primarily on two features - flaws in the decision making process and failures in the communication system across different divisions and hierarchical levels of the program (i.e. issues feeding information to the launch management team and the rejection of dissenting views).

The Rogers Commission Report (1986) stated: *“It is clear that crucial information about the O-ring damage in prior flights and about the Thiokol engineers’ argument with the NASA telecon participants never reached Jesse Moore or Arnold Aldrich, the Levels I and II program officials<sup>40</sup>, or J.A. (Gene) Thomas, the Launch Director for 51-L ... testimony reveals failures in communication that resulted in a decision to launch 51-L based on incomplete and sometimes misleading information, a conflict between engineering data and management judgments, and a NASA management structure that permitted internal flight safety problems to bypass key Shuttle managers.”*

#### *Organizational trauma:*

The data points to the tragic, demoralizing long-lasting effect the Challenger disaster had on JSC and wider NASA employees: *“Most Americans are unaware of the profound and devastating impact the accident had on the close-knit NASA team. The loss of Challenger and her crew devastated NASA, particularly at Johnson Space Center (JSC) and Marshall Space Flight Center (MSFC) and the landing and recovery crew at Dryden Flight Research Center... To this day Aldrich asks himself regularly, “What could we have done to prevent what happened?” Holding a mission management team meeting the morning of launch might have brought up the Thiokol/MSFC teleconference the previous evening. “I wish I had made such a meeting happen,” he lamented. The flight control team felt some responsibility for the accident, remembered STS-51L Lead Flight Director Randy Stone. Controllers “truly believed they could handle absolutely any problem that this vehicle could throw at us.” The accident, however, “completely shattered the belief that the flight control team can always save the day. We have never fully recovered from that” (NASA Historical legacy, 2010).*

## **STS Columbia Shuttle disaster**

Seventeen years after the Challenger space disaster, NASA experienced another tragic event with the STS Columbia Space Shuttle. At 9 AM on February 1, 2003, 16 days after launching, the Space Shuttle Columbia broke apart on re-entry into the Earth’s atmosphere killing all seven astronauts on board. Columbia was the second time NASA lost a shuttle and all its crew. All STS Space Shuttle flights were suspended for over two years during which time construction of the international space station was out on hold. NASA commissioned the Columbia Accident Investigation Board (CAIB) to establish the causes of the disaster. Following the investigation into the accident commentators claimed *“the events that led up to the loss of Columbia were eerily similar to those surrounding Challenger”* (NASA Historical legacy, 2011).

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<sup>40</sup> “The Challenger launch was coordinated by the top technical managers and administrators in NASA’s four-tiered launch decision chain. Among them were Jesse Moore, Associate Administrator for Space Flight, NASA Headquarters, Washington (Level I); Arnold Aldrich, Program Manager, Johnson Space Center, Houston, Texas (Level II)” (Cited in Diane Vaughan, 1996, p.1)

*Source of the crisis: Technical and cultural systems fault*

The Columbia Accident Investigation Board determined that the accident was the result of technical and the organizational cultural failings. Approximately 82 seconds after the Shuttle's launch a small section of insulating foam fell from the Shuttle's external tank, causing damage to the reinforced carbon panels on the orbiter's left wing. Foam insulation breaking off from the external fuel tank had been a persistent problem and this 'debris shedding' as it was labelled was a well-known to the program but management had deemed it acceptable. When it occurred on STS-107, it was initially assumed that a lightweight piece of foam could not damage the Shuttle's resilient reinforced carbon panels. However, the investigation found falling insulating foam has caused the second major shuttle failure. Organizationally, the CAIB identified problems in the program's culture. The panel determined they were unwilling to embrace dissenting points of view, and that the issue was part of a larger culture problem at NASA.

*Organizational trauma:*

The Columbia Shuttle disaster had a similar shock effect on JSC and NASA to that of Challenger: "on February 1, 2003, all of our lives were changed in an instant" (Letter excerpt from Space Shuttle program manager, 2003). Informants who were present at JSC during the time of the crisis and experienced firsthand spoke of the traumatic impact it had on the morale of the organization and described it as an emotional loss: "the [Columbia] shuttle disaster rocked this place [JSC]. It was tough, really tough ... we knew them, they were our friends. We saw them at church, we coached their kids at little league, they were part of the family" (Interviewee, Deputy Manager).

Data points to the crisis event having a long-lasting effect on the minds and consciousness of JSC and NASA employees, one of regret and guilt: "As with the loss of Challenger, NASA employees continue to be haunted by questions of "what if." "I'll bet you a day hardly goes by that we don't think about the crew of Columbia and if there was something we might have been able to do to prevent" the accident, admitted Dittmore [Space Shuttle Columbia Program Manager]. Wayne Hale, shuttle program manager for launch integration at KSC, called the decisions made by the mission management team his "biggest" regret. "We had the opportunity to really save the day, we really did, and we just didn't do it, just were blind to it." (NASA Historical legacy, 2010)

### **3. The reprinting process: a paradoxical influence**

According to Bednarek et al (2017) "paradox theory specifically focuses on contradictory poles that are mutually exclusive yet interrelated, and persistent over time" (p. 79). Hence, paradox reflects features that are in contradiction yet interdependent and continue to exist over time, and it is this understanding of paradox this finding adopts in referring to the reprinting process as a paradoxical influence. Holding to the assumption that in a given instance a process can either enable change or restrain it, for the conditions needed to support the change would seek to overcome the conditions restraining and delimiting change and, therefore would not

contribute to or partake in being the restraining force. However, with the reprinting process the study finds that in a given instance it simultaneously does both – in that it provides a platform to support change but in doing so it instantaneously generates a restraining force delimiting the character of change for future occurrences.

Furthermore, the reprinting process is a reoccurring process whose implications continue to manifest over time.

The reprinting process occurs parallel to sustained imprinting but is concerned with organizational characteristics that emerge post the organization's founding, and is triggered as a result of a past sensitive period, namely a major crisis trauma event. Identification of this process emerged from the research data and longitudinal analysis of JSC, major crises in its history and their subsequent effects. As with the imprinting concept (Johnson, 2007), crisis trauma as a sensitive period refers to a limited time period during which the organization is susceptible to influences, however in the case of reprinting, these influences are not exclusively the result of external environmental influences or founder/entrepreneurial traits but can be a result of endogenous crisis events and influences.

The study identifies that crises-trauma events are a significant feature of an organization's history, and can have a palpable shaping influence on the character of its present-day strategic change initiatives and perceptions towards exploration, exploitation and organizational change. The data found that crisis events and their consequential traumas provide a platform for two types of change – knowledge exploration and organizational and cultural systems – however, the long-term effects of crisis and trauma differ in character depending on the nature of the change the events produce and in some cases, it leads to long-term rigidities that restrict the limits of change and openness to experimentation. Importantly, the study finds that reprinting resulting from crisis and trauma events has a dual tensional effect with subsequent organizational change.

#### **a) Historical crisis events and trauma as a platform for organizational change**

Firstly, each of the major historical crisis events were defined as tragedies and signified traumatic painful experiences for JSC as an organization, provoking the Center to embrace positive change: “The tragedies galvanized the agency to learn from



these painful events” (NASA History, 2015). This finding concurs with principles advocated by prevailing change models that crisis events provide a platform to trigger for organizational change (Lewin, 1951; Schein, 1996). In retrospectively reflecting upon the major past crisis events in JSC’s history, participants expressed the view that the crisis events and the failures that instigated them as being necessary progressive periods in the organization’s history for internal learning and change:

“There's a lot of case studies that they put you through at NASA, where they actually show all these successful programs and then they'll go, "Hey, these critical disasters were essential for the program to move forward." On Apollo they had the fire. After that, they made all these changes that really made the program better and let them get to the moon. In the shuttle program, they had one disaster that caused everybody to back up and re-evaluate, then it was a much better program afterwards. There's kind of a feeling that those failures are almost necessary. That you push on a certain mind-set and you need that break to force you to back up at that point and go "Whoa. What's going on?", and to re-evaluate. And that's positive. That's very good. Seeing that always challenge my team to do is, "Can we do that without killing anybody?" (Interviewee, senior engineer)

In examining the learning and change that resulted from the JSC’s major historical crisis events, two types of change emerged as being directly related to the events: (1) technical knowledge, and (2) structural changes.

As a result, NASA has emphasized that the culture should be “prove it is safe” as opposed to “prove it is unsafe” when a concern is raised. The process is better, and the culture is changing as a result of both of these accidents. (NASA Historical legacy, 2010)

### ***Platform for technical change***

For example, post the Apollo 1 fire, JSC implemented a number of technical and organizational changes to the program. The Apollo 1 fire and the findings of subsequent review Boards (i.e. the Apollo 204 Review Board and NASA’s own detailed analysis of the Apollo program and its management) created a platform upon which the organization implemented a number of technical spacecraft hardware and procedural changes, with a core focus on improving crew safety. Technically, NASA defined the 100 percent pure oxygen test environment as hazardous and forever

changed what was considered a safe test environment for future test. Significant changes were also made to the materials used inside the spacecraft module by severely restricting and controlling the volume and location of flammable materials and a new hatch was designed to be quick opening.

"I can assure you if we had not had that fire and rebuilt the command module ... we could not have done the Apollo program successfully, so we owe a lot to Gus, and Rog, and Ed. They made it possible for the rest of us to do the almost-impossible." (Apollo Astronaut, CBS News, 2007)<sup>41</sup>

In the case of the Challenger Shuttle disaster, NASA/JSC on the technical and engineering front spent the next 2½ years fixing the hardware and improving processes, and made over 200 changes to the shuttle during this downtime and worked on design changes to improve the vehicle and these technical learnings were utilized on future space missions. The engineers and astronauts at JSC focused on developing an escape system and protective launch and re-entry suit:

"[we] included an escape module into the design of space vehicles. A feature that would be replicated in the next major space program - the ISS; and the Soyuz space capsule, which was sent up every six months for the purpose of changing out the emergency escape module that would be always attached to the International Space Station in the event of some destabilizing condition which made it no longer habitable. As a consequence the crew could then board the Soyuz and exit the Station with some very high assurance of returning to the surface of the Earth promptly" (ISS HQ report, 2013).

### ***Platform for structural change***

In 1967, following the Apollo 1 fire, Congress directed a structural change to the program and mandated the formation of an Aerospace Safety Advisory Panel, "to advise the administrator on safety in NASA's hardware programs. Congress also mandated a Space Program Advisory Council and a Research and Technology Advisory Council, reporting to the Administrator" (Bugos and Boyd, 2008: 146). Procedurally, the program redefined responsibilities for test procedures and

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<sup>41</sup> Excerpt from Morgan D. (2007). 'How Deadly Apollo Fire Helped Save NASA', CBS News. January 27.

established an independent Flight Safety Office that operated on two levels – at the NASA Headquarters level and also at the individual field centers, where the Office became responsible for reviewing “all aspects of design, manufacturing, test, and flight from a safety standpoint” (Apollo 204 Report, 1967).

The Challenger Shuttle disaster, NASA/JSC led to the development and implementation of a number of long-term structure and process related changes. The organization established several new offices, panels and roles of responsibility all focused on establishing more formal stricter safety systems at both the NASA agency level:

“Significant new procedures are being implemented to provide independent safety, reliability, maintainability, and quality assurance functions. A completely new organization, reporting directly to the NASA Administrator, now provides independent oversight of all critical flight safety matters...NASA has established an Office of Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA). A new position, Associate Administrator for SRM&QA, has been established, reporting directly to the NASA Administrator ...The NASA Office of the Chief Engineer was abolished, and the appropriate functions and resources of that office were transferred to the Associate Administrator for SRM&QA...” (Excerpts from NASA Report to President: Action to implement the recommendation, 1986)

And more specifically at the JSC Center level:

“In consideration of the number, complexity, and interrelationships between the many activities leading to the next flight, the Space Shuttle Program Manager at Johnson Space Center has initiated a series of formal Program Management Reviews for the Space Shuttle program...A Space Flight Safety Panel, chaired by astronaut Bryan O'Connor, has been established...” (Excerpts from NASA Report Implemented actions, 1987).

## **b) Cultural change: progressively restrained parameters of innovation and efficiency**

The data found that with each crisis cycle in JSC's history, the technical and structural learning and changes effected the culture of the organization. As an organization JSC connects its current safety culture to the major historical crisis events; "Our current Safety Culture ideals have been shaped by past tragedies such as Apollo 1" (JSC, Wilt, 2017)<sup>42</sup>. With each crisis JSC assumed a heightened safety culture, whereby with each crisis cycle safety systems and structures became stricter, more controlled and procedural. Consequently, the parameters for innovation, experimentation and efficiency changed, and is perceived to have become progressively constrained:

"And it used to be back in the old days like Apollo and stuff, you could do plenty of stuff. And even early shuttle days, yeah you could go make stuff, but now we over bureaucratize and over enforce rules, and, "No you can't do that. No you can't do that." There's got to be a reason why you can't do that" (Interviewee, senior engineer).

The findings suggest that as part of the reprinting process, the organization's original approach to innovation and efficiency was broader in scope in comparison to the organization's modern framing. It suggests the historical crisis events and related trauma rewrote aspects of these founding characteristics, establishing new imprints and operating behaviors for JSC that were more rigid. This aspect of the reprinting process creates progressive rigidity into the system and culture of JSC, which was found to be a consequence of the organization's deliberate attempt to prevent future occurrences of traumatic crisis events. For example, this is illustrated in the post-Challenger report and its change intention:

"our objective has been *not only to prevent any recurrence of the failure related to this accident, but to the extent possible to reduce other risks* in future flights...It fully recognizes that the risk associated with space flight associated with space flight *cannot be totally eliminated*" (Commission report, 1986, emphasis added)

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<sup>42</sup> Wilt G. (2017). JSC Emerge, 'Apollo 1 (AS-204) – Lessons and Legacies' presentation, February 6, [sma.nasa.gov].

The findings indicate that the reprinting process is a redetermination of the organization's risk paradigm where innovation and efficiency becomes progressively constricted and subservient to safety. The new risk paradigm being established as part of the reprinting process to prevent failure from occurring and remove as much risk as possible. For JSC these historical crisis events signified failure and in the contemporary context, it was to be avoided. In describing JSC's current culture, informants commonly quoted the phrases "failure is not an option" and "fear of failure", speaking of the organization being risk averse with limitations on what resembles accepted risk and innovation failure. One interviewee articulated:

"[post the STS Colombia accident] there was a little bit of creep into the system of, 'just don't ever let that happen again', which the sentiment is good, but they're trying to process it [risk and failure] out... You can't innovate in that environment. You cannot innovate and have a "We cannot fail" mentality. It's not possible" (Interviewee, Former JSC Senior engineer)

### **Redetermining the dominant risk paradigm: occupational risk**

The term 'dominant logic' herein refers to an organization's shared mindset and way of conceptualizing tools, processes, behaviors and modes of operating in order to achieve its mission (Kor and Mesko, 2013; Prahalad and Bettis, 1986). Based on analysis it emerged that the organization's dominant logic, specifically its risk perspective influences the parameters and boundaries of what it deemed tolerable innovation and efficiency.

A theme common across various sources of data was the view that human space flight is a highly dangerous endeavor and therefore risk is a central tenet of human space exploration and JSC's mission. The principle of risk and risk acceptance was often articulated with participants expressing sentiments that "it [human space flight] isn't safe. What we do is dangerous. We have to be willing to tolerate or accept some level of risk" (interviewee, former astronaut and Directorate Director). However, this perception extends beyond the case organization and is a foundational feature of the broader space industry, thus indicating a world view shared by a network of organizations, a space ecosystem. The space industry was birthed out of aviation and the early flight contributors came from the air force pilots accustomed to high occupational risk and had witnessed the loss of men's lives. In being an industry

wide feature, the dominant risk logic holds significance because it persists even when an organization changes its strategy, be it ambidextrous or otherwise, for it constitutes a defining feature that determines the operational capabilities of organizations in the field of human space flight.

The data found that one particular risk dimension was prominent at JSC – occupational risk. Occupational risk refers to the potential risks that occur as a consequence of activities undertaken by individuals in fulfilment of their job tasks. At JSC, this had a direct association with astronauts who, by virtue of their role (i.e. they travel to/from space in a highly combustible space vehicle and may perform extravehicular activity), absorbed a high degree of risk given that any failures could result in their loss of life. However, sensitivity to the personal occupational risk of astronauts was not restricted to the astronaut community but extended across the broader JSC organization and its employees. This sensitivity to the risk to astronauts is embedded within the culture of JSC and is encapsulated by the Center’s motto often repeated by actors, “failure is not an option”, a phrase coined after the Apollo 1 fire. As an organization, JSC procedures and processes are designed to intentionally mitigate risks to astronauts and crew as much as possible. A feature which manifests itself in operational processes and the organization’s culture, characterized by the testing and retesting of technology, hardware, processes, and systems for safety assurance.

During the early establishment of the human space program and the Manned Space Center (JSC) astronauts and the Center demonstrated a risk perception and expectation that accepted human life would be lost but it was part and parcel of the human space mission, and sought to manage the risk rather than mitigate or attempt to eliminate it.

“...I think we all expect to lose a man sometime. We’re working just as hard as we can work against it, of course. But in anything where you have equipment like this, as high speed, and as new equipment like this, we’re not hiding our head in the sand. We’re well aware somebody will get their head knocked off one of these days on some mission or other. But just as in aviation, we’ve all had many of our friends killed in aviation. This doesn’t mean that aviation progress stops and that we all go back and say we shouldn’t fly anymore. This program is worth running, well there’ll be times when people will probably get hurt but the program will go on and we’re not going

to stop our efforts. Meanwhile, we wanna make it just as safe as we can possibly make it” (Astronaut, CBS video archive, 1966-1967)

However, in the modern JSC organizational context the data indicated a different risk paradigm where the loss of human life is considered wholly unacceptable and structural and cultural measures seek to mitigate the loss of life at all costs.

“the risk was more acceptable back then [Apollo program]. You had test pilots that lost their lives all the time, and I'm not saying anybody thought that was okay, but it was accepted. We have military people who lose their lives all the time, that's not okay, but it's accepted, so we've evolved into a culture where it's not okay to lose an astronaut (Interviewee, Division Head).

#### **4. Surface manifestation: dual process of sustained imprints and reprinting effect in tension with ambidexterity**

Surface manifestations refers to the contemporaneous detectable structural and cultural features of the organization that play an active role in shaping JSC’s transition to ambidexterity. The study detected that sustained imprints and the reprinting process were dual processes actively occurring at JSC influencing the organization’s transition towards the pursuit of exploration and exploitation. The strategic transition underway at JSC revealed that certain sustaining imprints with origins in the organization’s founding now presented impediments in the new strategic context JSC found itself.

##### **a) Competency trap: sustained imprints conflicting with ambidextrous pursuit**

The data found that sustained organizational characteristics originating from JSC’s founding represents a competency trap (Levitt and March, 1988). Their association to historical achievements gives them value and contributes to their persistence, trapping the organization into continuing with these features even though they are not conducive to the new strategic vision for the organization.

In an effort to attain its new strategic vision for the dual pursuit for innovation with efficiency, JSC's underwent a reorganization in 2015 that sought to change historic features such as stovepipes as they were uncondusive to the new vision 'to advance human exploration with a structure and governance that is more lean, agile, and adaptive to change:

“This reorganization did not create new functions or abolish existing ones... a major goal of this reorganization was to enhance collaboration and reduce stove pipes and coordinate JSC exploration activities and resources. So, your core duties and functions won't change, but how you perform those duties and functions will likely evolve-- due to new partnerships and collaborations and expected efficiencies of scale in areas such as processes and procedures created by new offices and grouping of functions.” (JSC internal communications, 2015)

In the modern context of JSC, the stovepipes were seen as an inhibitor of innovation, collaboration and experimentation, indicating either a decay in the value of this feature, or the inclusion of other factors that now negate the historical benefit of this feature. Similarly, the militaristic style was described as a conformity mechanism “It's literally, you know your chain of command. You do not step out of your chain of command... There's like a mental socialization that occurs, so if you want to move up then you have to stick to the straight and narrow and not ruffle too many feathers...” (Office Lead). However, participants associated the new strategic visions (JSC 2.0) for innovation and efficiency with traits like “being open to diversity of thinking and dissenting opinions”, and being “outward looking” – features that did not fit with the militaristic style historically found in the organization.

#### **b) Reprinting: Accustomed to change**

In the context of the new strategy and the changes underway at JSC, interviewees who had worked at the organization spoke of being accustomed to change – changing missions, changing administrations: “we've had so many changes here we're used to change” (Division Chief). Participants related a familiarity with change connecting it to the various changes the organization has experienced in its past as a result of the crisis events, cancelled space programs (i.e. Space Shuttle and



Constellation). Informants explained that change was a significant part of JSC and its past experiences and had occurred in different forms, thereby being an activity the organization was accustomed with:

“Boy, [change] it's huge here ... I'll start with the huge [recent] changes, really it started beginning with the Columbia accident... So the change really started with the accident. Then came the next big change-- the return to flight. Getting shuttle back flying so we can finish the space station. That imposed a huge change on [JSC] areas, on my directorate... Then, I guess the next big, big change to come was President Obama was elected. When was that? '08 I guess? Yes, '08. So that was the beginning of yet another huge change. So, political. There was a political wave that now came sweeping across NASA, change from Bush to Obama, that was enormous-- it had an enormous impact in terms of change... So right around 2011, 2010, 2011 when the shuttle was finally into the road, STS 135 was the last mission. It's done, Constellation is over -- this was the next enormous change, was the double whammy; Constellation and shuttle both gone. We suddenly had thousands of people with nothing to do and no way of being funded, so huge lay-offs on the contractor side... So I'm just kind of outlining about a decade's worth of enormous change that affected JSC” (Interviewee, Division Chief).

In speaking of JSC's new strategy and change effort, some informants expressed an element of change fatigue as noted in comments like “JSC 2.0, we'll wait and see. This is just another change that will come and go” (Interviewee, Officer), thus reinforcing the point that change as a result of past experiences, including crisis events, had become familiar to JSC.

**c) Reprinting: redetermined risk logic conflicting with ambidextrous pursuit**

The dominant risk logic which had been redefined as a result of past crisis events was evident in the organization's strict cultural orientation around safety: “our safety ethic that had been baked into our Agency DNA,” (Oral History, Former administrator (b)).

Safety is paramount at JSC and it conditions the character of processes, systems and modes of behavior across the organization. The strong safety culture was

observed onsite in artefacts such as welcome mats with the message “safety has no quitting time” and signs emphasizing “safety first” and “safety begins here”. The data indicated that the culture of safety at JSC is a risk mitigating mechanism that has evolved over the course of the organization’s history, and in its contemporary form the safety culture was geared towards risk avoidance rather than risk management. Interviewees expressed that the organization tends to pursue risk avoidance strategies and practices and as a consequence was lacking in risk management capabilities. As such the organizational culture was regularly described as being highly risk averse, motivated primarily by the fear of the loss of life, an occupational risk.

“... before we cut metal, before we invest on a build or a test, we're going to lay out the detail plan anticipating everything that can go wrong and convince ourselves that that plan is sound and complete. So, we spend a lot of money on that plan, and a lot of time” (Interviewee, Former JSC engineer).

Notably, some participants expressed that this dominant risk logic bounded and constrained innovation and experimentation at JSC. One senior manager whose role involved actively engaging with new ideas and technologies and bringing them into JSC to improve performance and increase innovation expressed the tension, noting the strategic intent to explore and exploit capabilities involved challenging the prevailing JSC risk logic which in view of historical events was suitable to preserve life, but in the current context was an inhibitor:

“We try to connect new ideas, things that have not been tried out in space yet and aren't even close necessarily, but trying to move it closer so we could improve performance, make grand leaps in our technological capabilities. That's the intent of bringing nanotechnology to the Space Center... but it was always a bit of a battle against what JSC's culture is predominantly, which is failure is not an option, you've heard of before. That can have good connotations and bad. You knew about the good ones, right? Because of the movie Apollo 13, right? "Hey, we're going to get these guys home no matter what," Failure is not an option. But sometimes, that also means that failure and the potential of failure -even in a technology, is not tolerated, so taking risks when you're protecting the crew make all the sense in the world. You do not take unnecessary risks when humans are at stake and huge taxpayers investments. But when you're trying

to develop a new technology, or to take the next step, that same aversion to risk and desire to go with what's already proven and already tried and true goes against you, when you want to start challenging the type of structure you might want to use or the type of power system or battery system. It's a challenging place for people who are technology researchers, lower TRL [test readiness level] stuff" (Interviewee, senior manager)

The Center's new strategy was viewed to be promoting collaboration and partnerships, on a Center-wide scale in an effort to garner learnings on innovation and efficiency: "Partnerships are of mutual benefit. For we [JSC] get the benefit of learning new ways of doing things –insights into what other businesses do" (Interviewee, senior manager). The Center's new ambidextrous strategy and its inclusion of partnerships with commercial organizations signaled a disruption to the Center's historically rooted self-identity of being the solo knowledge experts in the field. The shift towards an exploration and exploitation ambidextrous strategy through the use of partnership and commercialization is the new feature perceived to be augmenting JSC's expert identity "now partnership and commercialization is changing this [JSC's position as knowledge center] with knowledge being shared and gained from partners" (Interviewee, Senior manager). Another interviewee exemplified this change tension and its manifestation in how the Center engaged with commercial partners:

"There's the change with commercialization in the ways we do vehicles, which on the engineering side has big cultural impacts because NASA doesn't cross-check every [one of commercial partners] safety decision. We have to step back. Let them have their accidents. Let them resolve them... NASA stepping back and not controlling all the science but instead enabling it is also a really dramatic change" (Interviewee, Division Chief)

Hence, the shift towards working with external partners shifts the knowledge center away from JSC, however, it was felt that the organization was struggling to change and break away from its historically embedded ideas:

"If you look at the implementation, we read the words and you say, "I want to be more agile. I'm going to be responsive to change". We should say "responsive to change" means we've got to look outside to see what the change is, but that's not happening in practice in many

cases – a lot of our effort is concentrated internally”  
(Chief technologist, 2017)<sup>43</sup>.

## DISCUSSION

This study set out to conduct an inductive case analysis of JSC examining how its history influences the way it approaches a strategic shift towards exploration and exploitation, ambidexterity. As such, this study is reflective of Kipping and Üsdiken’s (2014) ‘history *in theory*’ approach for it engages with history as an influencer of the organization’s contemporary function. Furthermore, its empirical founding serves to address the call for research that gives more explicit attention to history, and its influence on strategic practices (Kipping and Üsdiken, 2014; Suddaby and Foster, 2017). The paper refers to history as the sociohistorical context that shapes an organization’s strategic processes, practices and perceptions (Vaara and Lamberg, 2016). One concept that has received scholarly attention and is pertinent to understanding the shaping role of history is the theory of imprinting (Marquis and Tilcsik, 2013). In drawing upon this concept the study pays attention to particular sensitive periods in JSC’s history post its founding – namely endogenous crisis events characterized by trauma that occurred in the organization’s past. The research findings contribute to an underserved area in imprinting research by furthering our understanding of the imprinting dynamic by examining organizational history and the effect of historical crises on contemporary strategic change activity. In focusing on endogenously produced crises and trauma this paper shifts its focus from exogenous shocks and threats which has dominated research studies (e.g. Mainiero and Gibson, 2003; Schmitt et al, 2010), and contributes to expanding our understanding of a little explore and undertheorized feature of organizations (Sarkar and Osiyevsky, 2017). Figure 10, which is expounded upon below, presents a conceptual model conveying the core concepts emerging from the study and the interrelations between dimensions.

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<sup>43</sup> Terrier, D., Heracleous, L., and Gonzalez, S. (2017), p. 21

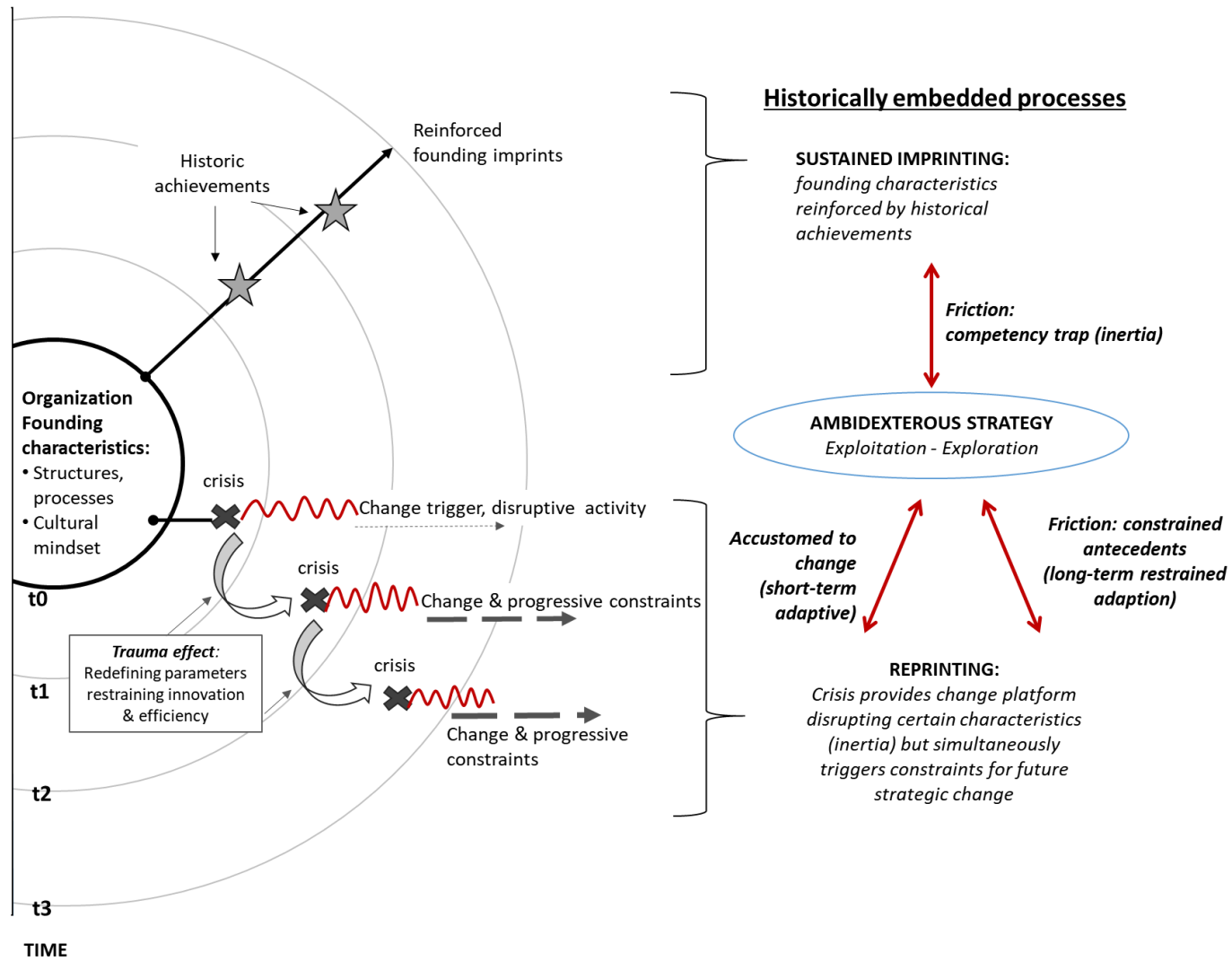


Figure 10: Conceptual illustration of historically embedded dual processes sustained imprinting and reprinting

The study finds that an organization's history is multidimensional and consists of distinct but interrelated features which manifested in two historically embedded processes which were simultaneously in operation – *sustained imprinting* and the *reprinting process*. Furthermore, the interaction of these two concurrent processes was found to condition JSC's contemporary perceptions and approach towards its new exploration-exploitation strategy and implementation at an organizational and individual level. As figure 10 demonstrates, in the case of JSC, these two processes have their origin in the organization's founding structural and cultural characteristics or imprints (Boeker, 1989; Johnson, 2007). However, the subsequent effect and outcome of these founding imprints upon the sustained imprinting process and the reprinting process differ, and even diverge over time.

In relation to the process of sustained imprinting, the findings highlight structural systems, and behavioral operating characteristics exhibited by JSC and its actors, were grounded within and representative of the militaristic siloed disposition of the 1950's-1960's space era when the organization was founded. However, what is significant about these founding imprints is not that they just persist over time, but in looking deeper it represents what Simsek et al (2015) refer to as amplification whereby the imprints become increasingly ingrained and a stable feature within the organization. Scholars (Blombäck et al, 2013; Johnson, 2007) highlight that gaps remain in our understanding of the mechanisms underpinning the retention and persistence of imprints and this study contributes in helping to address this gap by highlighting that prominent historical achievements in an organization's past serve as episodes in time that reinforce imprints. The findings show that JSC's founding imprints were perpetuated owing to significant historical achievements accomplished by the organization and the expert identity these accomplishments bestowed. Hence, historical achievements represent prominent episodes in an organization's history, and by attaining these feats by means of historically established attributes and imprints, success becomes associated with these structures, systems and behaviors first established at founding. The suggestion that sustained imprints can be underpinned by historical achievements correlates with existing evidence that success reinforces imprints (Barnett and Pontikes, 2008). Furthermore, historical achievements imbue these associated imprints with value and subsequent achievements serve to reinforce the success of the founding imprints and continues to underpin its ingrained persistence. This view of historical achievements and imbued value relates with Van

Driel and Dolfsma (2010) who suggest values imprinted on organizations has behavioral and cognitive implications on sustaining the imprints. Historical achievements and the value affiliated with them is seen to provoke an inertial force that reinforces these imprints and deems them effective for ongoing operations. Although Simsek et al (2015) refer to path dependency, performance feedback and institutionalization as examples of reinforcing mechanisms, this study proposes that historical achievements are an additional mechanism for though the influence of accomplishments contributes to mechanisms such as path dependency and the escalation of commitment, it equally operates independent of them. Hence, this view of historical achievement provides a nuanced understanding of the forces underpinning the sustained stability of certain imprints.

As with the sustained imprinting process, the second historically embedded process represented in figure 10, the reprinting process, has its roots in imprinting theory in that it refers to the organizational attributes shaped by environmental conditions (Stinchcombe, 1965). However, the reprinting process was found to be a dynamic process that reoccurs over time, and therefore portrays the progressive transformation of imprints (Simesek et al, 2015).

As figure 10 shows, the reprinting process begins with the organization's founding imprints, however the occurrence of unanticipated crises triggers the reprinting process. Organizational crises in the context of this study refers to unanticipated, negative events triggered by internal factors (Roux-Dufont, 2009), which disrupts the organization's status quo and development path at a specific time period (Sarkar and Osiyevskyy, 2017), and requires corrective action (Dutton, 1986). Crises influence an organization's long-term strategic efforts (Seeger et al, 2005), yet limited attention has been given to examining how past crisis events influence an organization's contemporary strategic activity including a strategic shift towards ambidexterity. Organizational crisis is a frequently observed phenomenon which occurs at various times throughout an organization's development, however studies have tended to examine and analyze crisis and trauma as a solo occurrence (e.g. Seeger et al, 2005). A distinguishing feature of this study is that it examines a series of historical crisis trauma events experienced by JSC. In analyzing the organization's historical crisis and trauma events cumulatively, the study helps builds an understanding of how crises relate, and accounts for the cumulative experience and

the compounded impact cycles of crises can have on an organization (Mias deKlerk, 2007). The study shows how crisis and trauma events occur not as solo episodes with confined repercussions, as is generally presented in literature, but in a cyclical manner, where the repercussions of one event become the basis upon which change and imprinted behaviors arising from subsequent crisis events are built upon. Hence, the conditioning effect of historical crisis is layered over time and with each new layer come nuances in behavioral traits. The study therefore contributes to change and crisis management literature by providing a better understanding of how crisis events affect an organization, how these events are linked over time and the consequence of these connections.

The study finds that post-founding crisis events represent salient sensitive periods, thus providing empirical evidence that an organization experiences multiple sensitive periods during its lifetime (Marquis and Tilcsik, 2013). These sensitive episodes experienced by JSC were triggered not by external environmental influences or founding individual(s) as purported in imprinting studies, but were endogenously provoked, cultivating organizational vulnerabilities that resulted in the crisis events (Roux-Dufont, 2009). Furthermore, these crises events were distinguished by trauma, thus providing more specification to the nature and boundaries of post-founding sensitive periods. The findings show that the series of unanticipated crisis events each produced a traumatic effect and a phase of heightened sensitivity to the imprinting process. The trauma experienced by JSC members equates to the shock phase in Fink et al's (1971) crisis model, causing disruption to the organization's collective thinking and emotional distress.

Having identified crisis-trauma events as a trigger of the reprinting process, analysis indicates that this process consists of two distinct, opposite but interrelated activities – the act of change and rigidity. These two elements are reflective of Helfat (1998: 49) 'adaption versus rigidity' tension within history-dependent activities. Helfat (1998) presents these dimensions as alternatives, suggesting that a historically embedded activity or process produces either change or rigidity. Similarly, Sarkar and Osiyevskyy (2017) note that in relation to existential crises, organizations are either stimulated to change *or* become rigid in an effort to preserve established structures and practices. However, the paradox lens would suggest that it is possible for these two opposite elements (change and rigidity) to be interrelated and occur simultaneously (Lewis, 2011). In the case of the reprinting process the study finds that



both change and rigidity are discernable activities that actively occur, but they are also interrelated, for in pursuing change post the crisis-trauma event, JSC also established rigidities that redefined future strategic activity. Thus the reprinting process can be seen to be a paradoxical manifestation of a historically embedded process.

To expound upon the change element further, the JSC case analysis indicates that each crisis-trauma event engendered visible change in the organization, which corresponds with existing studies and theorizations (e.g. Seegar et al 2005; Szymanski and Schindler, 2017), and the contention of change models which view crises as a trigger for change (Lewin, 1951; Schein, 1996). The ensuing changes diverged from JSC's previous way of operating, prompting structural, operational and cultural changes and triggered the development of organizational patterns and structures (imprints) that differed to those created at its founding. With each cycle of crisis, JSC implemented technical, organizational and structural changes. Hence, the resulting imprints arising from one crisis event became the foundation upon which imprints are transformed or new ones established in subsequent crises, representing a layering of organizational patterns. The study does not find evidence of the decay or elimination (Simsek et al, 2015) of imprints as such, but rather existing structural systems, processes and modes of behaving are adapted and transformed, and new attributes (imprints) are created. In establishing these structures and reorganizing resources, consequently these changes become the new status quo which the organization strives to maintain until the next crisis-trauma event triggers another change cycle.

However, as figure 10 illustrates, crisis events not only triggers disruptive change activity as part of the reprinting process, but as a consequence of the trauma effect (Simuth, 2017) derived from crises, it simultaneously generates an implicit supplementary process that engenders rigidity in the organization's cognitive and cultural framing of innovation and efficiency over time. In experiencing emotional and cognitive distress as a result of the fatal crisis events, JSC was predisposed to change, but the change was underpinned by an intrinsic deterrent to avoid a repeat of such events – a point illustrated by the JSC motto 'failure is not an option'. Thus, within the reprinting process, as JSC undergoes change it simultaneously operates a defensive mechanism whereby it redefines and progressively restrains the parameters of what it deems acceptable for risky exploration and efficiency orientated activities in an effort to avoid the reoccurrence of a traumatic crisis event. This redefining process occurs with each crisis cycle and subsequent change initiatives arising from later crises build

upon these redefined parameters and progressively delimitS the scope of these activities. In other words, the crisis events lead to change in the short term but simultaneously create scope rigidities for future cycles of change, innovation and efficiency.

The reprinting process can be seen to resemble Lewis' (2000) concept of paradox and reinforcing cycles. Lewis asserts, "as actors seek to resolve paradoxical tensions, they may become trapped within reinforcing cycles that perpetuate and exacerbate the tension, for paradox is a double-edged sword. Tensions might serve as "a trigger for change", spurring actors to rethink existing polarities and recognize more complicated interrelationships. Yet, tensions simultaneously inhibit change" (2000: 763). In the case of the reprinting process, we see that both dynamics occur simultaneously, for the crisis event provokes reprinting and induces the organization to change; and simultaneously, it implicitly leads to the organization establishing rigidities in how it classifies and perceives exploration and exploitation activities. Thus, reprinting signifies a negative adjustment in the organization's operating paradigm, and reflects a paradoxical self-reinforcing cycle. Whereas imprinting theory relates to persistent patterns and features established at the organization's founding (Marquis and Tilcsik, 2013), reprinting represents a second order ramification arising from sensitive historical crisis events occurring post its founding. The successive occurrence of such crisis-trauma events triggers the reprinting process which in turn transforms and/or creates imprints which become layered over time and have long-term consequences on the organization's functioning behavior.

In addition, the reprinting process is reflective in part of van Driel and Dolfsma (2010) contention that imprinting is a dynamic recurring process that conditions and locks-in the organization. For van Driel and Dolfsma (2010) 'lock-in' refers to continuity of imprints and not rigidity. However, with the reprinting process and its paradoxical elements, we see that this process represents both continuity *and* rigidity. Thus reprinting extends van Driel and Dolfsma (2010) view and provides a deeper understanding of the complexities that can inherently exist with imprinting as a recurring process. Simsek et al's (2015) framework implies that over time imprints are dynamic and can evolve over time as opposed to remaining static. The study of JSC contributes a nuanced empirically based understanding of the dynamic evolving quality of imprints. Furthermore, figure 10 illustrates that imprints assume both a

dynamic quality *and* a static one, as represented by the historically embedded processes ‘sustained imprints’ and the ‘reprinting process.’

The coexistence of sustained imprints and reprinting, two historically embedded processes, indicates a dual process whose interaction is manifested in JSC’s contemporary enactment of the strategic change effort to implement ambidexterity (figure 10). In relation to the change process, Kriauciunas and Kale (2006) suggest the “solution firms identify or where they look for information to address the problem might be influenced by how or what they first define as the problem” (p. 665). In other words, how organizations approach change depends on how they frame the problem. Extending this argument further, the findings from this study suggest that when transitioning towards an explore-exploit strategy, how the organization frames these activities and attempts to fulfil them is dependent on historical events and the parameters by which it defines exploration-exploitation activities as a result of the reprinting process.

In JSC’s contemporary environment its new strategic agenda of innovation (i.e. the search for new knowledge, openness towards distant knowledge, collaborative learning with non-aerospace and commercial entities and the reduction structural silos); and exploitation (i.e. streamlining cumbersome processes to further innovation efforts), sustained founding imprints (i.e. the continued utility of founding behavioral and structural imprints) came into conflict with the organization’s ambition for ambidexterity. The continued presence of these sustained imprints represented a competency trap (Levitt and March, 1988). And with regards to the reprinting process, the impetus for change generated by the process imbued JSC with a degree of familiarity to adaptation and change. However, the countervailing force of rigidity within reprinting, operationally and cognitively, progressively constrained the organization’s perception of exploration and exploitation and formed bounds around how JSC defined and approached the simultaneous implementation of exploration and exploitation activities. Consequently, it presents a friction with JSC’s strategic ambition and implementation for ambidexterity. The manifestation of this friction became evident, for example, in that the search for new knowledge was a struggle and inconsistently pursued. This new context of exploration stretched JSC’s historically defined and accepted parameters of what constituted exploration. Similarly, efficiency and exploitation activities were historically conditioned on the basis it did not

compromise safety, minimized risk and had been tested and proven to work (consequences of JSC's cycles of crisis-trauma events). Yet, in this new strategic context of ambidexterity, exploitation and the drive for efficiency presented a friction to this standard.

The temporal perspective to organizational history maintains that actors operate in an 'ongoing present', meaning that through present materials, an organization's past is continually enacted in its present and future (Schultz and Hernes, 2013). Although Schultz and Hernes (2013) apply this lens to identity reconstruction, the findings in this study find application to organizational change. The reprinting process is found to be an ongoing process which manifests in existent actions and decisions of actors engaged in the change process. The view of history having a continual active influence on contemporary change helps to deepen our understanding of the complexity of its influence, and takes it beyond the current perceptions of history as being an 'either-or' phenomenon. The study shows that in dissecting an organization's history, certain elements of it have a paradoxical influence that extends to the present.

### **Perspectives for future research**

The findings presented in this paper open up several avenues for further research. The study demonstrates the multidimensional nature and influence of organizational history by giving closer examination to organizational imprinting. In identifying two distinct historically embedded processes – sustained imprinting and the reprinting process – the study contributes to our understanding of how an organization's history and past crisis-trauma events influence its present strategic context. Future research can extend analysis of organizational history by developing our understanding of sensitive periods and examine whether entities and other organizations are equally susceptible to trauma events and the ensuing reprinting process as reflected in this study, or whether trauma events play a particular role in redefining imprints.

The study identifies that the occurrence of the reprinting process is conditioned by crises and has a paradoxical influence. Exploring whether other features of an organization's past are characterized by paradox, how it conditions the organization's function and what are the long-term effects, could further our understanding. Future research could also unpack the reprinting process further by

looking at whether the paradoxical process of change and rigidity results only from crises characterized by trauma or can it be extended to other sensitive periods?

Furthermore, research could examine the reprinting process from a different analytical perspective, such as sensemaking. Such an approach could help reveal the related cognitive constructs traversing crisis events and the redetermination of activities such as exploration and exploitation. Future examination could also explore and expand upon the underlying factors contributing to the existence of the reprinting process, its reproduction and also whether the reprinting process occurs in reverse. The role of leadership and key actors in shaping the reprinting process could provide a multi-level understanding of the concept. In addition, discursive analysis (Paroutis et al, 2013) exploring how meaning is redefined during reprinting could provide depth to understanding this complex historical process, and the way in which is used by organizational members in the strategy process.

# Chapter Five

## Conclusion

### Introduction

The research program within this thesis set out to investigate the concept of organizational ambidexterity and *how* an organization develops this capability by empirically examining the process by which an organization transitions to simultaneously manage exploration-exploitation, and the underlying mechanisms which either support or hinder the process. Through an extensive qualitative multi-level case analysis of an organization undergoing strategic change targeted towards the dual and effective pursuit of exploration and exploitation, the research project contained within this thesis provides a nuanced understanding of the phenomenon rooted in empirical real-world practice. Drawing upon qualitative research methods (i.e. ethnographic and grounded theory approach), and multiple primary and secondary data sources, the study helps to address some of the theoretical and empirical gaps that exist in our comprehension of ambidexterity. In exploring an organization's journey towards ambidexterity, this research project provides nuanced insights positioned in the intersection of organizational ambidexterity, organizational history, and the interplay of the formal and informal organization.

### Summary of three papers

The core chapters within this thesis contain the three papers that convey the core findings emerging from this research project. All three papers are drawn together by the overarching concept of change which is inherent in an organization's strategic shift towards becoming organizationally ambidextrous. The following briefly discusses the three papers contained within this thesis and summarizes the resulting contribution. Table 12 details key aspects of each of the three papers.

Paper one examines the concept of complementarity between the different approaches to ambidexterity. Scholars conceptually acknowledge and that the pathway to ambidexterity involves a combination of structural and contextual solutions, yet empirically ambidexterity studies have tended to examine ambidexterity either through the lens of structural differentiation or contextual integration, thus limiting our understanding of how an organization integrates different antecedent as it transitions towards achieving ambidexterity (Agostini et al, 2016; Asif, 2017). Employing a longitudinal in-depth case analysis of a large organizational division within the case organization, this study looks at how different structural and contextual approaches were employed during the division's strategic pursuit for exploration (science) and exploitation (engineering). The findings identify a hybrid approach where different modes are integrated in a progressive layered manner, and is underpinned by an oscillating dynamism in the exploration-exploitation tension. The study contributes to our understanding of how the process to achieving ambidexterity 'works in practice', and the underpinning mechanisms involved within the process.

Paper two examines the interplay between the formal and informal organization in practice during an organization's strategic transition to ambidexterity. Through an ethnographic analysis of actors across multiple levels of the case organization, JSC, the study identifies an emergent practice – 'the practice of circumventing' – that arises out of the interaction between formal and informal organizational elements and, under certain condition, has the capacity to engender exploration and exploitation activities. The study finds that though this practice resembles a positive deviant behavior, it fulfils Teece's (2007) categorization of the micro-processes of dynamic capabilities. The study contributes to expanding our understanding of how the dynamic interaction between the formal and informal organization provides a flexible enacted practice mechanism for promoting exploration and exploitation, and its contribution towards dynamic capabilities.

Paper three examines how organizational history and past crisis-trauma events influence and shape an organization's contemporary strategic change to ambidexterity. Employing a longitudinal case analysis of JSC the study examines its 50 years long history, its founding imprints and historical crisis-trauma events. The study finds that organizational history, particularly past crisis-trauma events have a significant influence on the organization's contemporary framing and perception of exploration and exploitation activities. Furthermore, it identifies two historically embedded

processes – sustained imprinting and the reprinting process – which actively influence the organization’s contemporary context by having a paradoxical effect in that it engenders the organization to change but simultaneously establishes rigidities impeding the organization’s adaptation towards ambidexterity. The study contributes a multidimensional understanding of the role of organizational history and its influence on contemporary strategic activity, and provides insights on how history can forge paradoxical tensions in an organization’s present strategic context.

### **Limitations and future research direction**

This study and its findings stem from a multi-level analysis of a single case organization. Though this approach provides depth and rich insight into the reality of an organization’s strategic transition towards ambidexterity, its pathway and the mechanisms involved, the study has limitations.

In conducting a single-case analysis of the pursuit of ambidextrous activity, this research project is open to the critique of ‘micro-isolationism’ (Seidl and Whittington, 2014: 1408), for the organization under study, JSC, is the focal interest and therefore bounds the setting in which the phenomenon is studied. However, in explicitly examining history, the influence and shaping force of external environmental factors, and the deliberate engagement of informants outside the focal organization in interviews, this project in part broadens its empirical scope and reduces its degree of separation from the larger, macro factors involved in the phenomenon. In addition, the ability for this research project to generalize from the data is limited given that organizations have idiosyncratic characteristics and therefore the data may capture nuances relevant to the organization under study. This study could be advanced through multi-case comparative analysis (Eisenhardt, 1991) and follow in the vein of inductive studies of multiple cases (e.g. Ozcan and Eisenhardt, 2009; Ozcan and Santos, 2015). Eisenhardt and Graebner (2007) notes that “while single-case studies can richly describe the existence of a phenomenon...multiple cases enable comparisons that clarify whether an emergent finding is simply idiosyncratic to a single case or consistently replicated by several cases” (p. 27). Furthermore, extending this research through the use of multi-case can serve to strengthen its ‘analytic power’ (Eisenhardt and Graebner, 2007: 27) and address construct validity and robustness



concerns by reinforcing emerging theory-building (Yin, 2014). It would also contribute to developing a broader theoretical framework of the ambidexterity phenomenon.

Using a single-case methodology allows for the study of complex phenomenon such as organizational ambidexterity and allows rich insights to be captured. However, it is limited in terms of replication and therefore raises questions around whether or not the same findings would be gained if the study was conducted at another organization(s).

In terms of avenues for future research, this study focused on understanding an organization's management of the exploration-exploitation tension to become ambidextrous, and the mechanisms and structures involved in the process. Future research could extend emerging findings highlighting dynamism in the exploration-exploitation relationship. Studies could explore whether this occurs under other contexts or situations beyond those identified in this study (i.e. converging priorities, lifecycle changes, and contradictions with interdependent organizational capabilities). This would help expand our understanding of the drivers for the dynamism and the organizational contexts in which it occurs. Although the central focus of this research program has been the exploration-exploitation tension, future studies could go further by examining other organizational tensions to see if the relationship between the dimensions is similar and demonstrates dynamism, and if so, why? Such a study would broaden our view of tensions in terms of areas of cross-over and areas of difference. Furthermore, in exploring how different approaches to ambidexterity are integrated in practice, we find empirical evidence for an evolving hybrid mode, where approaches are progressively combined over time in layers and build upon previous modes. Future research could explore this line further to see if there are other patterns of integration employed by organizations and if so, how does it operate?

In exploring some of the mechanisms and processes actively involved in enabling an organization's pursuit for organizational ambidexterity this study identified features such as the interplay of the formal and informal organization, managerial dynamic capabilities and unconventional structures, as contributing underpinning/micro mechanisms. Future structures could give more focus to such constructs as this would further our understanding of how ambidexterity is generated beyond current conceptualizations and could provide new practice insights. This study also gave attention to organizational features and mechanisms which potentially

hindered the organization's transition to ambidexterity. In analyzing this feature the study found that organizational history and past crisis-trauma events can have a paradoxical change-rigidity influence on an organization's contemporary strategic activity of exploration and exploitation. Future studies could expand on this history dimension future to see what other specific features or sensitive periods in an organization's past influence its ambidexterity strategy, and the resulting consequence (i.e. is it enabling or impeding). In identifying two historically embedded processes – sustained imprinting and the reprinting process – this study gives insights into the dynamic influence of history and its related processes. The reprinting process provides another interesting avenue for future research. Future studies could unpack this concept further and see if there are other aspects undiscovered in this study, the role of leaders in this process and whether the paradoxical influence is an integral part of the process or only occurs under certain circumstance.

	<b>Paper One</b>	<b>Paper Two</b>	<b>Paper Three</b>
<b>Research questions</b>	How antecedents to ambidexterity are harmoniously engaged within an organization, and why would such a condition occur; and what organizational features underpin this manifestation?	How do emergent informal practices interact with formal organizational elements, and vice-versa, to engender ambidexterity, and does this interaction contribute towards the organization's dynamic capabilities?	How do historical events in an organization's past influence its current approach to strategic change, and what role do historical crisis events play in an organization's development and transition towards ambidexterity?
<b>Main findings</b>	<ul style="list-style-type: none"> <li>i) An organization's pursuit of ambidexterity is a change process that engages with and layers different antecedents over time</li> <li>ii) The exploration-exploitation tensions is dynamic and in flux, where both are actively present but the emphasis and organizational focus fluctuates over time due to lifecycle phases, converging priorities and contrasting but inter-reliant capabilities</li> <li>iii) The transition to ambidexterity requires reshaping the organization's internal context and middle managers are a critical mechanism to achieve change by means of dynamic capabilities and dynamic managerial capabilities</li> </ul>	<ul style="list-style-type: none"> <li>i) The interplay of the formal and informal organization is manifested in enacted practices such as the practice of circumventing</li> <li>ii) The interplay of formal and informal organizational elements can act as a dynamic capability, whereby the actor is capable of exercising sensing, seizing and reconfiguring processes to promote exploration and exploitation</li> <li>iii) Formal authority and informal status moderate the outcomes of the practice of circumventing, and the degree to which long-term reconfiguration occurs</li> </ul>	<ul style="list-style-type: none"> <li>i) An organization's history can have a paradoxical influence on its present-day strategic change, for it can attune the organization to change yet simultaneously restrict the parameters of its change</li> <li>ii) Organizational crises represents a sensitive period in an organization's development during which it is susceptible to developing new characteristics and behaviors</li> <li>iii) The reprinting process is a secondary imprinting type process that occurs post the organization's founding as a result of crisis and trauma events</li> </ul>

<p><b>Theoretical significance</b></p>	<p>i) Contributes to our understanding of the nature of explore-exploit: In the context of explore and exploit activities being simultaneously present and active (i.e. non punctuated equilibrium context), the relationship between the dimensions is not constant but fluxes under situations of converging priorities, lifecycle dynamics and contrasting, yet interdependent capabilities</p> <p>ii) In identifying the evolving hybrid approach where different antecedents are combined progressively over time in a layered pattern, the study contributes to expanding our understanding of how antecedents are engaged integratively in practice, and in so doing enhances understanding of the equifinality of ambidexterity</p> <p>iii) Furthers the middle management perspective by showing that their context-reshaping capacity extends beyond implementing strategy, and that under conditions of organizational cognitive dissonance middle managers become the significant creators and designers of change capabilities at the organizational and individual level.</p>	<p>i) Contributes to our understanding of the interaction of the formal and informal organization as an embodied practice – the practice of circumventing – and that these voluntary positive deviant behaviors exhibit the micro-foundational process of dynamic capabilities (sense, seize and reconfigure), and under certain circumstances, have the ability to contribute and reshape an organization's internal context, and at multiple levels of the organization</p> <p>ii) Advances understanding of the mechanisms involved in achieving ambidexterity by showing that the informal organization can promote this endeavor organically, in that such practices are endogenous and emerge through the voluntary actions of organizational actors</p>	<p>i) Contributes to our understanding of imprinting sensitive periods by identifying post-founding crisis-trauma events as sensitive periods which can have a paradoxical change-rigidity influence on an organization's contemporary strategic activity through the process I term reprinting</p> <p>ii) Highlights the multidimensional influence of organizational history for the effect of history on an organization's present strategy should not be viewed as the activity of one process but the interaction of multiple historically embedded processes (i.e. sustained imprinting and the reprinting process)</p>
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<p><b>Implications for practice</b></p>	<p>i) Highlights to managers that in certain situations the relationship between exploration and exploitation is not constant but in flux; therefore, organizations can expect to experience continual fluctuations in their emphasis of explore and exploit activities, as they pursue both activities simultaneously</p> <p>ii) Aids managers and practitioners by expanding their understanding of the role and capabilities of middle managers as a context reshaping mechanism beyond the implementation of strategy (i.e. designers of change capabilities at the organizational and individual level)</p>	<p>i) Gives practitioners insight into how informal practices can interact with formal organizational elements and what the manifestation of this interaction looks like in practice</p> <p>ii) Demonstrates to managers that under certain conditions, actors exhibit positive deviant behavior which goes against organizational norms but produces beneficial outcomes supporting and promoting explorative and exploitative activities</p> <p>iii) Highlights to practitioners that practices geared towards change and alignment can occur organically and voluntarily from the informal organization and informal practices utilized by actors at different levels of the organization, and not just through formally recognized processes and procedures directed by senior management</p>	<p>i) Demonstrates to practitioners that organizational history can have an intricate influence on its present day context, way of behaving and approach to strategic change, for it has the capacity to simultaneously motivate change and provoke resistance</p> <p>ii) Reveals the role and effect historical crises and trauma events can have on positioning an organization for change, and highlights to managers the significance of consciously being aware of the structures and cultural mechanisms developed by the organization as a defensive response to such events and the effect these have on the organization's current context and approach to explorative and exploitative activities</p>
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Table 12: Summary of key research findings and contributions

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# APPENDICES

## Appendix A

### Sample Questions from Interviews

#### Examples of questions asked throughout data collection

1. What does JSC 2.0 mean (i.e. being lean, agile and adaptive to change) to you and your organization? What do you think it is trying to achieve, and how do you interpret it?
2. What do the terms innovation and efficiency mean? Do you think it has the same universal meaning across the organization?
3. How would you describe the culture here at JSC, and what do you think needs to change to make JSC 2.0 happen?
4. How do you understand the change occurring at JSC? What are some of the changes underway in your organization in response to JSC 2.0, please describe them?
5. Please tell me about when you first joined JSC, what were your experiences and how have things changed?

#### Examples of questions targeted to individuals involved in the largest division (ISS program)

1. What is the core role of the RISE change initiative and how did it come about? What is the strategic mandate you are working towards?
2. What was going on internally/externally that brought about a realization that change was needed?
3. Is the culture in the program different to that of the Center, and if so how?
4. Having witnessed the transition of the ISS from assembly to full utilization, describe the transition process, what were the critical factors and your key lessons learnt?
5. The distinction between science and engineering, how is this understood in the program, and how does it manifest in the program? What challenges does this distinction present and how do you overcome them?

#### Examples of questions tailored to specific individuals

1. The interaction between the business and technical side of the organization, what issues if any, arise as a result of this distinction?



2. How does the organization define risks and manage risks? Are risks categorized and defined the same way across the Center and what are the distinctions?
3. How do you know if the strategy has been successful? What is the measure of success?
4. In terms of competencies and skills, what do you think is needed for innovation and efficiency to occur effectively and simultaneously at JSC/in your organization?
5. How do you know if the strategy has been successful? What is the measure of success?

## **Appendix B**

### **Selected case organization, JSC**

Established in 1961, the NASA Johnson Space Center (JSC) is the hub of all human spaceflight activity for NASA and is one of NASA's largest research and development facilities. The Center has served as the mission control for all manned in-orbit missions from the Gemini, Apollo and Skylab projects of the 1960s -1970s to the more recent Space Shuttle and International Space Station (ISS) programs. Throughout its history JSC has played a direct role in a number of NASA's innovation achievements including the moon landing of 1969 and the launch of the Hubble telescope in 1990. However, the organization has also experienced fatal disasters - the Apollo fire of 1961, the Space Shuttle Challenger disaster in 1986, and Space Shuttle Columbia explosion in 2003. Historically, NASA held a monopolistic position in space activities with the government agency being the only customer in the U.S space industry. However, since 2010 the organization has experienced a high degree of change in its internal and external environment.

In 2010 under the Obama Administration, JSC's burgeoning Constellation program was abruptly cancelled and a new Space Policy was implemented which called for the agency to operate within a commercial arena. This triggered the emergence of US commercial space and private sector entrants with the likes of Orbital ATK, Blue Origin and SpaceX. The commercial space industry has evolved seeing a growth in private and commercial entrants who in 2015 accounted for 76% of global space activity, representing approximately three-quarters of all global economic space

activity (The Space Report, 2016)<sup>44</sup>. For JSC this shift in policy towards commercialization changed its operational dynamic and introduced new business relationships. The agency would no longer be the sole customer and owner of space hardware and the private sector was no longer limited to the role of contractor. In this evolving environment, JSC (and by extension the wider NASA agency) would operate as one of many customers and the private sector is now an integral partner with its own vested interests.

Moreover, in March 2013 US Congress implemented a “sequestration” imposing across-the-board cuts in discretionary spending among Defense and federal agencies over the coming 10 years. This placed further budgetary constraints on JSC and the wider NASA agency who had seen a consistent progressive decrease in its budget allocation (see appendix F). This shifting landscape signaled an unprecedented degree of change for JSC and in an effort to redirect and align the organization with its new environment, JSC Center Director, Dr. Ellen Ochoa, announced a new strategy in the spring of 2013 intended to pursue innovation alongside efficiency, sustainability and affordability:

“We know that we need to operate under the constraints of scarce resources and ongoing uncertainty. My concept of JSC 2.0 asks a fundamental question: If we were starting JSC today, how would we build a space center to reach our vision of leading a global enterprise in human space exploration that is sustainable, affordable and benefits humankind? [...] How would we be organized to most efficiently and effectively carry out our work? What tools and processes would we use? How can we be more nimble and adaptable to change, and stay that way in the future? I hope everyone at JSC will engage in “re-inventing” JSC so that both our current programs and projects, as well as ones we hope to carry out in the future, will be successful” (Dr. Ellen Ochoa, 2013: 2)<sup>45</sup>

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<sup>44</sup> The size of the global space industry combines satellite services and ground equipment, government space budgets, and global navigation satellite services (GNSS) equipment. In 2016 this was estimated to be \$324 billion. Government space budgets represent the second largest contributor to the industry with an estimated share of 24% of the global space economy, with the US government spending \$44.57 billion on its space efforts in 2015. Source: Federal Aviation Administration (FAA), *Annual Compendium of Commercial Space Transportation: 2016*, January 2016; FAA AST: Washington DC [[https://www.faa.gov/about/office\\_org/headquarters\\_offices/ast/media/2016\\_Compndium.pdf](https://www.faa.gov/about/office_org/headquarters_offices/ast/media/2016_Compndium.pdf)]

<sup>45</sup> NASA JSC Roundup: Fantastic Voyages, Spring 2013 (magazine)

What's more, Dr. Ellen Ochoa's new strategy also spoke of exploration and the intention of a "reinvigorated JSC mission statement, emphasizing our role in pioneering humankind's presence in space" (JSC features, 2016)<sup>46</sup>.

## Appendix C

### Instances of U.S. legislative attempts to terminate the ISS Program

- House of Reps introduced bill to terminate the Space Station Freedom program. H.R. 5393 - To terminate the Space Station Freedom program – 102<sup>nd</sup> Congress, June 1992 (1991-1992)
- Senate introduced bill for Deficit Reduction through Space Station Freedom Termination Act of 1992 (see, "S. 2930 - Deficit Reduction through Space Station Freedom Termination Act of 1992: 102<sup>nd</sup> Congress (1991-1992), July 1992)
- Bill introduced to terminate the ISS program held in 1993 (see, 'H.R. 1856 - Space Station Freedom Termination Act of 1993: 103<sup>rd</sup> Congress (1993-1994)').
- U.S. Senate Bill to terminate ISS program, January 1993 (see, 'S. 462 - Deficit Reduction Through Space Station Freedom Termination Act of 1993: 103<sup>rd</sup> Congress (1993-1994)
- Termination Bill introduced May, 1993 (see, 'H.R. 2050 - To terminate the Space Station Freedom and Advanced Solid Rocket Motor programs, and to redirect the savings therefrom to deficit reduction, and to National Aeronautics and Space Administration space and civil aviation programs. 103<sup>rd</sup> Congress (1993-1994)
- Bill to terminate the program introduced in May 1994 (see, 'H.R. 4451 - To terminate the International Space Station Alpha program, and to redirect the savings therefrom to National Aeronautics and Space Administration space and civil aviation programs: 103<sup>rd</sup> Congress (1993-1994)
- House of Reps. ISS termination Bill introduced in 1995 (see, 'H.R. 407 - To terminate the International Space Station Alpha program. 104<sup>th</sup> Congress (1995-1996)'
- Senate ISS termination act, January 1995. (see, 'S. 157 - Reduction of Federal Spending Through Space Station Termination Act of 1995: 104<sup>th</sup> Congress (1995-1996)
- Bill to terminate the program introduced in 1997 at the start of ISS construction (see, 'H.R. 1831 - To terminate the United States participation in the International Space Station program. 105<sup>TH</sup> Congress (1997-1998)'
- Amendment sought to eliminate the authorization in the bill for funding of the international space station. "H. Amdt. 1102 to H.R. 3322 – 104<sup>th</sup> Congress (1995-1996). Failed by recorded vote: 127 – 286 [H.R. 3322 - Omnibus Civilian Science Authorization Act of 1996 – 104<sup>th</sup> Congress (1995-1996).
- Amendment sought to cancel funding for the International Space Station. "H. Amdt. 775 to H.R. 4194 — 105th Congress (1997-1998). Failed by recorded vote: 109-323"

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<sup>46</sup> JSC Features. Coffee chats jolt creativity for JSC 2.016 initiatives [electronic communications]  
<https://jscfeatures.jsc.nasa.gov/pages.ashx/471/Coffee%20chats%20jolt%20creativity%20for%20JSC%202016%20initiatives>

[H.R.4194 - Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1999 – 105<sup>th</sup> Congress (1997-1998)]

- Amendment sought to terminate the International Space Station program. “H.Amdt.107 to H.R.1654 – 106<sup>th</sup> Congress (1999-2000). Failed by recorded vote: 92 – 337 [H.R.1654 - National Aeronautics and Space Administration Authorization Act of 2000 – 106<sup>TH</sup> Congress (1999-2000)]
- Amendment sought to eliminate funding for the international space station program. “H.Amdt.423 to H.R.2684 – 106<sup>th</sup> Congress (1999-2000). Failed by recorded vote: 121 – 298 [H.R.2684 - Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 2000 – 106<sup>th</sup> Congress (1999-2000)]

Source: US Congress. Available from:

<https://www.congress.gov/search?q={%22source%22:%22legislation%22,%22search%22:%22International+space+station%22}&searchResultViewType=expanded&pageSort=relevancy&page=2> ) [Accessed 24-01-2017]

## Appendix D

### Vignettes: Empirical examples of episodes of the practice of circumventing

*Vignette 1:* Example of organizational actor circumventing steps within a formal process:

Following the radical changes that occurred in its environment in 2010, JSC was mandated to establish strategic partnerships and collaboration initiatives with external organizations to develop new technologies and commercial avenues to apply them. This new policy meant the development of a number of new procedures to standardize the process of developing new partnerships with commercial organizations. One of the key new processes developed was JSC internal contractual approval and sign-off process which authorized the partnership. The approval and sign-off process was designed with a number of review stages (including legal reviews), after which it would receive official sign-off from the executive director. Due to the bureaucratic nature of JSC administrative systems the approval process was known, both internally to JSC and externally by potential partner organizations, to be a long slow process. Nevertheless, one of JSC Division Deputy Manager’s had successfully developed a partnership opportunity with a large local organization for innovation collaboration and had received the necessary approvals informally. All that was left was completion of the formal sign-off process confirming approval of the contract. A contract completion date had been agreed by both JSC and the new partner and both parties awaited its finalization. The Division Deputy Manager regularly checked on the progress of contract in the sign-off process, however, as the agreed completion date

grew closer it became apparent to the Division Deputy Manager that the partnership contract would not be sign-off in time. Realizing that this delay could jeopardize the future of the partnership the Division Deputy Manager decided to intervene. Having established that the contract had been reviewed and Okayed by the necessary internal reviewers, a critical step in the review process, the Division Deputy Manager skipped the remaining administrative steps in the process and submitted the contract directly to the Executive Director for sign-off. However, this action to skip the remaining administrative steps was perceived negatively by senior management and resulted in the contract being pushed back to the administration office and was advised that the skipping steps in the process should not be performed as it would only result in further delays. The Division Deputy Manager reflected that “I don't mind if JSC does its processes or whatever it needs to internally, but when it reflects badly on JSC and our brand to the external partner we're trying to collaborate with then it bothers me” (Division, Deputy Manager), thus showing that the practice of circumventing was not enacted for personal gain but to promote efficiency and innovative collaboration.

*Vignette 2: Example of senior management circumventing layers of hierarchy*

One of the core operational directorates at JSC redesigned and implemented a new training program for all of its technical operators in order to reduce the training period and upskill staff quicker and more efficiently. The senior management team detected that delays and operational issues occurring during the implementation of the new training program was due to middle management resistance. Some of the middle managers felt that the new training time period was not long enough to develop the necessary operational skills and knowledge, and was also an unfair departure from the way things had been done in the past. The management team believed that the new training plan was a strategic way of realizing efficiency and maintaining high morale in staff, particularly in younger employees. To realize the new training plan the management team intentionally circumvented the entire middle management level and set about performing a series of informal interactive activities to communicate with and engage directly the lower level employees who would be affected by the new training plan to drum up their support. In doing so the management team's utilization of the practice of circumventing promoted efficiency and resulted in the successful implementation of the new training program which, in the long-term, resulted in successfully changing the formal training structure permanently.

*Vignette 3: Example of middle management circumventing hierarchy layers*

The largest program in operation at JSC underwent a major change initiative designed to transform its culture, operating processes and systems so that the program could execute science exploration and routine engineering activities effectively and simultaneously. This change initiative had been initiated and designed by a group of middle managers who had, through voluntary means, identified structural inhibitors in the organization's pre-existing systems and culture preventing the program from fulfilling its strategy for effective and concurrent operations of science exploration and

engineering excellence. The middle managers took their assertions to senior management who commissioned the middle managers to design, develop and implement a change strategy to resolve the obstacles and embed the simultaneous management of science innovation and engineering excellence into the fabric of the program. The change consisted solely of middle managers who were pulled from their routine jobs and redeployed to focus solely on developing the new change strategy. From its outset the change team operated as a separate transient unit with a different reporting line outside the program's hierarchical chain of command. Supported by the program executive, the change team would report directly to the executive, thereby intentionally circumventing a number of upper management hierarchical layers including their own line managers. The middle managers identified that by circumventing layers of upper management they could reduce structural hindrances creating dissonance between upper and lower levels of the program which were impeding the program's ambidextrous strategy being translated into its operations. This reporting structure also allowed the executive to monitor the strategy's development closely and also gave visibility to workings on the ground thereby removing one of the structural inhibitors previously identified by the middle managers. From their beginning, the change team were given full design freedom and authority by the program executive to explore and make solutions as they saw fit and all boundary constraints were removed from the group other than retaining the program's structure and maintaining safety. As a consequence of the change team's unconventional design and reporting structure a successful strategy was developed promoting science exploration activities alongside engineering excellence. With the leader of the change team later being integrated into program management during implementation of the change initiative helped to instill permanent change into the program's hard systems such as processes, enabling systems and performance management mechanisms as well as intangible features including the program's cultural norms.

*Vignette 4: Junior employees circumventing levels of hierarchy*

Within the informal organization at JSC some divisions practice "skip-level meetings". This practice is intended to overcome recognized structural inhibitors (i.e. middle managers) so that employees at lower levels of the organization can have direct access to senior management to share ideas, explore ways to be innovative, ask questions and provide constructive feedback on current organizational affairs in an unstructured prescribed manner. The practice is a repeated activity that occurs in some but not all divisions across JSC as it is a voluntary practice – attendance is voluntary although management make a point to make themselves available to attend. The practice is exercised within the informal organization through informal means however depending on a division's particular sub-culture and systems of working it can take different forms. It is a practice that is supported by some divisions but is not mandated by the formal organization. This bottom-up interaction was perceived to be better received and promote in positive outcomes promoting the pursuit of innovation and efficiency driven activities in comparison to other informal non-supported "skip-level" attempts because although these junior employees lack formal

authority they benefit from a higher degree of informal status because not only do they know who their management are, but have direct access to them and know that this action is supported by their management who possess a high degree of formal authority. Although some middle and senior managers were perceived to find this form of the practice of circumventing unnerving, because it had support from the management team of that particular division, there was no perceived resistance to the “skip-level” meetings. An outcome of these meetings was the identification and implementation of incremental changes by junior members intended to instill small process orientated changes geared towards promoting efficiency; and also the development of small informal innovation-centered groups who gathered in their own time to pursue small innovative projects of common interest.

## Appendix E

### Overview: JSC founding history

In 1958 at the height of the Cold War, and in reaction to the launch of the Sputnik, the world’s first artificial satellite by the Soviet’s the previous year, President Dwight Eisenhower signed a public order creating the National Aeronautics and Space Administration (NASA), by incorporating its predecessor, the National Advisory Committee for Aeronautics (NACA)<sup>47</sup> (1915-1958) into a federal agency dedicated to space exploration; and so ensued the space race with the U.S.S.R and the U.S.A. competing for technological dominance in space.

Within days of NASA’s founding came the creation of the Space Task Group (STG), a working group of engineers based at Langley Research Center, Virginia, who were responsible for US manned spaceflight projects. In 1961, following President John F. Kennedy’s speech setting the goal to put a man on the moon before the end of the 1960s, NASA Administrator James E. Webb scaled up the STG unit transforming it into the Manned Spacecraft Center and in 1962 moved the Center to larger facilities Houston, Texas:

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<sup>47</sup> See following resources for an exposition of the National Advisory Committee for Aeronautics (NACA) (1915-1958): Bugos, G.E., and Boyd, J.W. (2008). Accelerating entrepreneurial space: The case for an NACA-style organization. *Space Policy*, 24: 140 – 147; NACA Annotated Bibliography.

“Houston, your City of Houston, with its Manned Spacecraft Center, will become the heart of a large scientific and engineering community.” (President John F. Kennedy, 1962)<sup>48</sup>.

In 1973, the Manned Spacecraft Center was renamed the Lyndon B. Johnson Space Center (JSC), and this organization is the focus of this research project. JSC is famed for Mission Control Center (MCC), a unit which since its inception has managed the running of flight activities for all human space mission operations throughout the Agency’s history - the Gemini project, Apollo program, Skylab, Apollo-Soyuz, Space Shuttle flights – including the first moon walk in 1969. Today, JSC is responsible for managing flight operations to and from the International Space Station (ISS) and oversees the development of the new Orion space vehicle and contributes towards the Commercial Crew program.

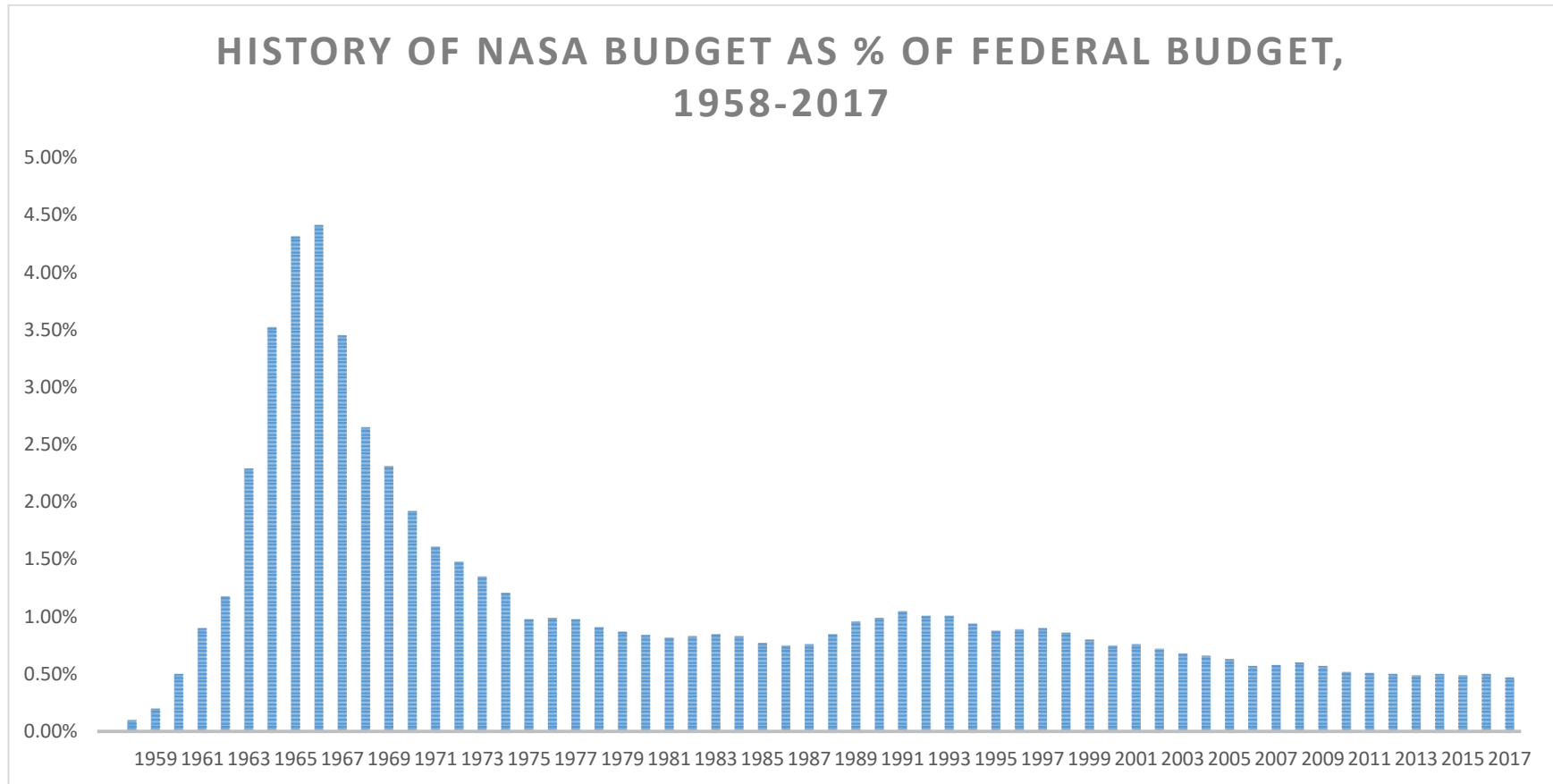
Since the end of the Shuttle program in 2011 NASA no longer has the capability to transport astronauts to space and has since become dependent on Russia and the use of its Soyuz vehicle to carry U.S astronauts to the International Space Station, paying \$71 million per seat. In 2010, the Obama Administration announced a new NASA program, the Commercial Crew Program (CCP). The program sees NASA invest in a number of U.S commercial companies to facilitate the design and development of a new breed of transportation capabilities to take U.S astronauts to and from low-earth-orbit (LEO) and the International Space Station (ISS). The CCP program roused a shift in NASA’s focus away from in-house technological development towards commercially developed spaceflight, and signaled an adjustment for NASA and JSC in the area of human spaceflight. Critically it meant that the development of forthcoming space transportation vehicle hardware and technologies transporting US astronauts to space would no longer be the sole domain of NASA but resided also with private space companies. Going forward, NASA and JSC is reliant on space crafts designed, manufactured and operated by private companies to transport cargo and humans to LEO and the ISS. Through the development of Space Act Agreements (SAA), NASA has awarded more than \$8.2 billion to accelerate the commercial program and enable commercial entities to collaborate in the development of its technological capabilities.

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<sup>48</sup> President John F. Kennedy Moon Speech - Rice Stadium, September 12, 1962. Speech transcript. <https://er.jsc.nasa.gov/sch/ricetalk.htm>



## Appendix F



Source: Data sourced from U.S. Office of Management and Budget (OMB)

