

THE SYSTEMS THINKING LEARNING LENS:
AN EXPLORATORY STUDY OF EXECUTIVES' MENTAL MODELS

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ABSTRACT

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It has become progressively difficult for businesses to tackle unanticipated events and define the influencers that generate unintended business consequences. As such, uncertain and ambiguous situations are now the prescriptive norm for many companies. Executives are at the forefront of having to make sense of the uncertainty to seek the ideal decision pathway. The purpose of this exploratory research study was to seek what is known about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of 12 global executives working in the United Arab Emirates (UAE) within complex adaptive systems (CAS) and their understanding of their thinking patterns that may have assisted in learning how to develop a systems thinking mental model to manage business ambiguity. Three research questions were developed to identify the types of experiences, perceptions, thinking patterns, and enablers—be they

within the individual, organizational, or environmental context—that may have provided a strategic learning path. The research questions include: (a) What characterizes the mental models the executives hold (the distinct nature or features of their beliefs, behaviors, and principles)?; (b) What are the experiences that provide the scaffolding in developing a systems thinking mental model (experiences and events)?; and (c) What aspects of the individual, organizational, and environmental interactions enable individuals to learn how to develop a systems thinking capacity (relationships, systems, and elements)? The qualitative exploratory research study used three data collection methods: (a) semi-structured interviews, (b) focus group session, and (c) demographic questionnaire. The researcher concluded from the findings, analysis, interpretations, and synthesis that: (a) a systems thinking mental model is reflective of and responsive to different elements, situations, and influencers; (b) certain behaviors are an integral part of a systems thinking mental model; (c) informal learning experiences in ambiguous and uncertain situations may provide an ambiguous thinking learning pathway; and (d) learning through social, cultural, and operational systems is an under-utilized strategic intent.

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DEDICATION

This dissertation is dedicated to my husband, John Sutherland, who provided the unending support in my continuous learning journey; who was always there to listen to my thoughts; who provided encouragement when my mental road blocks took hold; and who was the foundation that enabled me to reach this academic achievement. I would also like to share this dedication with my children, Bailey and Jake Sutherland, who provided the positive enthusiasm and interest in my studies and never wavered from their chant: “You can do this.” I am full of gratitude for their love and support.

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Chapter I

INTRODUCTION

This exploratory study sought to expand what is known about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of 12 global executives working in the United Arab Emirates (UAE) within complex adaptive systems (CAS) and their understanding of their thinking patterns that may have assisted in learning how to develop a systems thinking mental model to manage business ambiguity. The research questions were designed to identify the types of experiences, perceptions, thinking patterns, and enablers—whether within the individual, organizational, or environmental context—that may have provided a strategic learning path. The aim of the exploratory research was to provide more understanding of and insights into how learning occurs in ambiguous environments.

Chapter I introduces the research problem of learning more about how to develop a systems thinking mental model. It describes the context of the exploratory study and provides the framework to identify the executives' thinking patterns or mental models that may have assisted in the development of a systems thinking capacity. The research problem was developed through a review of the current body of literature and research to verify the research gap and areas for potential further study. Additionally, Chapter I

includes the Research Purpose, Research Questions, Researcher Perspectives, Rationale and Significance of the Study, Definitions, and Summary.

Five main concepts were used within this dissertation: (a) systems thinking, (b) mental models, (c) a systems thinking mental model, (d) complex adaptive systems, and (e) ambiguity thinking strategies. These concepts are introduced in Chapter I and are described in detail in Chapter II, the Literature Review. Each of these concepts is defined to enable the reader to build contextual awareness of and connections in how each of these concepts are interrelated to provide a unique research approach to understand more about how a systems thinking mental model is learned within ambiguous environments, specifically complex adaptive systems.

The 12 executives identified for the study were considered, as per Marshall and Rossman's (2010) definition, as "elites" (p. 159). Elites are stated as individuals with "power and influence and are considered influential, prominent, and/or well informed in an organization or community and are selected for their in-depth perspectives" (p. 159). The protocols for participant selection were the executives must have worked in the UAE and have more than 10 years of experiences working within at least two complex adaptive systems. The complex adaptive systems selection criteria, as described in Chapter II, the Literature Review, include domains that may have the presence of multiple stakeholders or multiple business models; connections to joint ventures and partnerships; or major or frequent external interrelated influencers from the business, government, or academic domains. The selected participants must also have worked within the highest executive level or operated within one reporting line for the highest level and may have had titles such as CEO, CFO, or President.

While the selected executives were not measured cognitively to identify the presence of a systems thinking capacity, the researcher only selected executives who have led and completed unique or multiple large-scale projects and showed evidence of continual career progression within complex adaptive systems. It would be difficult to verify if an executive had a systems thinking mental model prior to conducting the interview; thus, the researcher relied on the criteria built into the participant selection, domain CAS criteria profile, and the executives' experiences and context for ambiguity and complexity. Additionally, the research was not intended to prove the evidence of systems thinking, but rather to seek the perceptions and deeper understanding of the thinking patterns of those who operate in conditions of ambiguity. The next section provides an introduction to the dissertation's key concepts, with a detailed description and definitions provided in the Literature Review.

Concept Overview

Systems thinking has been described as “not a science” and is often explained as a conceptual framework (Cabrera, 2006). Conversely, Richmond (1993) described systems thinking as both a paradigm (a set of thinking skills) and a learning method (process, language, and technology). Given the paradigm differences, it is challenging to condense systems thinking into a succinct definition. However, key systems thinking theorists do agree on a broad understanding that systems thinking is the ability to embrace a holistic vision across the organization to see the moving agents with crucial connections, interdependencies, and a network of relationships (Cabrera, 2006; Checkland, 1999; Richmond, 1993; Sterman, 1989a).

An additional concept used frequently within the dissertation is “mental model,” which is defined as the thought processes or cognitive constructs that people use to understand the world, make assumptions, create knowledge and shape their perspectives (Craik, 1943; Johnson-Laird, 1983; Senge, 1990). Mental models are developed through “learned experiences and create the behavior patterns and actions that guide people within different situations, events and environments” (Johnson-Laird, 1983, p. 10).

Thus, by linking the two concepts, systems thinking and mental models, the term *systems thinking mental model* was developed for this dissertation as a concept to learn more about this type of thinking and behavior mind set within ambiguous environments. The researcher proposed the concept of a systems thinking mental model as the cognitive and behavior capacity to reflect on, examine, and adapt perspectives, and to seek meaning from dynamic connections, interactions, experiences, and behaviors to determine the ideal decision pathway. The premise is that by becoming more cognitively attuned to the nuances of the systems, one may be able to use certain behaviors and thinking patterns to leverage the fluidity of uncertain situations from the individual, organizational, and environmental perspectives as “complex business problems can rarely be solved through linear, analytical or reductionist thinking” (Ackoff, 1981, p. 353). A systems thinking mental model may be a useful thinking attribute, given that uncertain and ambiguous situations are now the prescriptive norm for many companies and executives are at the forefront of having to make sense of the uncertainty.

The next major concept included in the dissertation is complex adaptive systems (CAS). Holland (2005) described CAS as “systems that involve many components that adapt or learn as they interact” (p. 1). Complex adaptive systems are identified through a

few characteristics and include: (a) a large number of interacting elements within the systems, in that the elements interact with one another and the interactions are associated with the presence of feedback mechanisms, where the interactions produce non-linearities in the dynamics of the system (Morel & Ramanujam, 1999; Price, 2004; Sherif, 2006); (b) the systems can absorb external pressures and can be significantly altered by minor influences (Fioretti & Visser, 2004); (c) the system has the ability to self-organize and adapt (Sherif, 2006); and (d) the complex system tends to exhibit emergent properties and patterns (Ferlie, 2007).

Forrester (1971) suggested that the characteristics of complex systems make it difficult for people to work in those types of environments and stated that thinking errors occur because “cause and effect are often separated in both time and space and the problem resolutions that improve a situation in the short term often create larger problems. In essence, people have difficulty understanding behavior over time or the impact of feedback loops” (Sweeney & Sterman, 2000, p. 285), and they fail to learn from their mistakes (Forrester, 1971).

Ambiguous situations are prevalent within complex adaptive systems as ambiguity results from the growing network of economic and behavioral variables and a large number of agents interacting that send signals (or feedback loops) back into the system, which results in a change in the system behavior, ultimately creating unintended circumstances (Weick, 1995). Thus, a second term developed for this dissertation was *ambiguity thinking strategies*. This term helped to provide understanding of and offered an ‘organization operational’ perspective on how cognitive learning practices give context and understanding of how executives can align inexactness, paradoxes, or

uncertain situations (ambiguity) within the business context (principles and practice) and the ideal conditions (influencers, elements, interactions and knowledge making architecture) to create an ideal learning pathway to assist in the development of a systems thinking mental model.

These five concepts provided the foundation which led the researcher to explore what is known about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of 12 global executives working in the United Arab Emirates (UAE) within complex adaptive systems (CAS) and their understanding of their thinking patterns that may have assisted in learning how to develop a systems thinking mental model to manage business ambiguity.

Statement of the Problem

The problem addressed in this dissertation stems from the lack of understanding of how a systems thinking mental model is learned. More understanding of the various learning approaches is needed as each corporate complex situation is seemingly unique and “difficult to predict as social, economic and behavioral implications create unintended consequences” (PwC Annual Review, 2015, p. 3). The systems thinking literature is comprehensive and provides theoretical attention to the merits of *what* systems thinking is; however, there are still a gap and uncertainty in understanding *how* to develop the mental models that augment this intellectual cognitive capacity. According to Vogt (as cited in Chawla & Renesch, 1995), “In the Knowledge Era, *how* individuals learn (the process) and *why* they learn (the context) may be more important than *what* they learn (the content)” (p. 295). Leveraging Vogt’s concept, an exploration of how

executives draw on their past experiences, make inferences, and understand different perceptions to make informed decisions may provide a mindset blueprint or ‘a systems thinking mental model’ of how executives learn within ambiguous and uncertain situations. Yorks and Nicolaides (2013) supported this focus by stating that “learning experiences that develop an awareness of one’s mindset and its impact on one’s thinking and acting under conditions of ambiguity and uncertainty is critical” (p. 4).

However, the concept of systems thinking is still difficult to conceptualize, measure, or even observe. The challenges of how to develop or apply systems thinking is still largely not fully understood. Yoon and Kuchinke (2005) stated that “systems thinking models do not state when and how collaboration within the organization takes place to build systems thinking” (p. 16), and Shrode and Voich (1974) indicated “there is still a failure to even describe systems and a vagueness of what’s included in systems thinking” (p. 88). Even further, Atwater, Kannan, and Stephens (2008) suggested that people “must be trained in the principles, concepts and tools of systems thinking to understand and work effectively with and within complex social systems” (p. 10). Compounding the lack of understanding of systems thinking, Sweeney and Sterman (2000) conducted research on stock and flow structure, which indicated that heuristics or rule-of-thumb practices produced suboptimal decision results, leading to thinking errors. Argyris’s (1985) research on Theories in Use addressed organizational issues as he analyzed transcripts of over 1,000 subjects who participated in a study showing that the executive’s mind “involves inferences about another person’s behavior without checking if they are valid and advocating one’s own views abstractly without explaining or illustrating one’s reasons” (p. 89).

Since learning systems thinking within ambiguous or uncertain situations has no predefined learning path, understanding more about adult learning theories such as learning from experience, and situated and informal learning methods at the individual level is important to explore (Argyris & Schon, 1978; Dewey, 2004; Marsick & Watkins, 2001). Furthermore, research from the organizational level through the social, network learning, and relational perspectives may also provide insights into strategic learning opportunities to understand the context of various learning events (Bronfenbrenner, 1994; Lave & Wenger, 1991; Lewin, 1936; Senge, 1990, 1994; Surowiecki, 2004). Researching these learning theories from various perspectives—individual, organizational, and environmental—may also elicit key insights into the types of relationships, learning environments, situations, or mechanisms that provide ideal learning pathways.

Interestingly, despite the learning awareness gap which makes systems thinking difficult to define, measure, see, and understand, some seasoned executives may not have been formally trained in systems thinking and have learned to develop this cognitive capacity and are adept at understanding the direct and indirect information dynamics that enable good decision making. Thus, this exploratory study sought to identify the variables involved in the various thinking patterns from the executives' perspectives who may not have had any formal systems thinking training and work in complexity or positions with ambiguous problems to understand more about the learning elements involved in the development of a systems thinking mental model.

The Academic Gap

Adults need information to learn and must be able to construct knowledge from that information in real time, not in a classroom and, certainly, not tomorrow. The ambiguous and uncertain workplace insists that executives learn ‘on the fly’ and within the ‘here and now’ for maximum efficiency. Thus, exploring insights into how executives find information, construct knowledge, and apply and share what they know is the new corporate strategic modus operandi. However, there is a gap within the academic and business literature of how a systems thinking mental model can help to understand the true nature of uncertainty and contribute to learning from it.

The allure of learning to ‘think differently’ or more strategically has captured the business market with international best-selling business books as the ideal learning space for new and innovative business ideas. Amazon.com, the international e-commerce retailer, attracted over 71 million people to shop for books on Amazon.com between 2013 and 2016 (Statista, 2017) and a search on Amazon.com in January 2019 resulted in over 10,000 critical thinking books, over 40,000 books on problem solving, and over 60,000 books on strategy. While using the key words ‘system thinking,’ Amazon.com only displayed approximately 2,000 books and only 80 books for ‘systems theory’ in the title. Most recent academic database research results within the Teachers College, Columbia University library EBSCOhost with the key words ‘systems thinking’ between the years 2010 and 2019 yielded 923 books, with only five books with systems thinking in the title. A secondary search on ProQuest Digital Dissertations & Theses portal revealed 5,138 dissertations with systems thinking in the title within the last 5 years

(2014-2019); comparatively, there were over 64,383 dissertations with ‘problem solving’ and 33,418 dissertations with ‘critical thinking’ in their titles.

A major issue to understanding systems thinking is the term *systems*. This term conjures up the image of technical and mechanical components for many people. Even key theorists such as Ackoff (2015) and Senge (2011) conducted presentations that suggested it is time to call systems thinking a different term since it creates a barrier for generalized understanding. Interestingly, within the adult learning domain, theorists have conducted research on various cognitive competencies and developed concepts that are closely aligned to the term *systems thinking*. This includes Kirkpatrick and Locke (1991) who used the term *cognitive ability* as “the ability to process large amount of information and formulate strategies and solve problems,” while Zaccarro, Kemp, and Bader (2004, cited in Northouse, 2015) used the term *social intelligence* which they defined as “having such capacities as social awareness, social acumen, self-monitoring and the ability to select and enact the best response given the contingencies of the situation and social environment” (p. 10). While theorists have used the terms *cognitive ability* and *social intelligence* within the Trait Theory (Kirkpatrick & Locke, 1991), the similarity stems from the cognitive ability approach.

Compounding the learning gap, the plethora of systems thinking frameworks and conceptual models are based on decision sciences with formal instructional methods including simulations, cognitive assessments, and causal maps that augment systems thinking capability. This leaves a learning gap opportunity for an exploratory research study to uncover informal systems thinking learning strategies for business application that utilize adult learning theories as the foundation.

The research for this study was narrowed to include systems thinking within ambiguous environments and through the adult learning lens to explore how current research is addressing the understanding of mental models within the ambiguous workplace. More awareness of an ideal set of cognitive tools to view corporate issues through a holistic lens may be beneficial to examine the linkages and interactions among the elements of the whole system. More understanding of the research's context and participants will provide a foundation for understanding more about how messy, ambiguous, or complex problems cannot be understood from one perspective or by dissecting each element within the situation.

UAE and Global Executives

This study was situated in the United Arab Emirates (UAE) and explored a diverse group of executives who were working within ambiguous situations that may be prevalent within CAS organizations. Exploring ambiguous situations within the UAE was ideal as this small nation has a population of only 9.1 million and is one of the most developed countries in the Arab Gulf. This country has developed an infrastructure in macroeconomic growth activities and global trade investments (World Economic Forum Report, 2016) and has made huge investments in tourism, financial, manufacturing, communication, and construction (World Bank Flagship Report, 2017). The UAE also ranked 17 of 140 countries on the global competitiveness index 2015-2016. This situation of economic growth and diversity created both challenges and opportunities for how to manage the increasingly complex global market and it was crucial that executives be able to address the dynamic and instantaneous changes that arose. The macro changing

landscape impacted how executives sought information, made decisions, designed corporate strategies, and achieved their growth targets.

While looking holistically at ambiguous situations within CAS help to understand the 'system as a whole,' the individual executives working were involved in unique situations that are too complex to predict accurately. Thus, executives must learn the dynamics of the interplay between known and unknown knowledge to construct their own knowledge and ambiguity thinking architecture. In the UAE, the typical executive has between 20-35 years of global experiences, and whether the executive is a UAE national who has been groomed for a leadership position, a seasoned expatriate executive hired for a specific role, or an executive within a joint venture enterprise, one of the key criteria to their success often is their ability to learn to navigate and make informed decisions in the changing corporate landscape. Highly educated executives may still struggle with the pace of change and the increase in complexity and uncertainty. The complexity aspects of this landscape are managed through solid business planning practices; however, uncertainties also need to be understood to a higher degree. Executives need to understand the vast information processing demands and adapt to the changing systems, as domain knowledge may not be enough to ensure that corporate performances match expected outcomes. Understanding more about these non-routine situations through the adult learning lens may provide a strategic learning path to better business decisions (Marsick & Watkins, 1990).

Research Purpose and Questions

The researcher aimed to explore the executives' perspectives and understanding of their thinking patterns as they aligned with the concept of a systems thinking mental model. Thinking within ambiguous situations poses unique challenges and the researcher intended to learn more about the executives' perspectives through the participants' learning lens. This exploratory study sought to shed light on the variables influencing the development of a systems thinking mental model. The researcher reviewed the different adult learning models that may have led to the strategic learning path.

The research questions delved into what might be known about how the participants' thinking patterns and the influencers and elements within the executives' experiences, the workplace, and the environment may have influenced their perceptions on how a systems thinking mental model is developed. The three research questions framed the intent to capture the rich context that conceptualizes a systems thinking mental model at the individual, organizational, and environmental level. Specifically, the research questions migrate from the individual cognitive perspective, outward toward the larger organizational context which may include the type of events and experiences within the workplace, and further expands into the environmental sphere where influencers may be from external systems, relationships, or elements.

The three main research questions and subquestions are:

Research Question 1: What characterizes the mental models the executives hold?

(the distinct nature or features of their beliefs, behaviors, and principles)

- A. How do the executives' beliefs of ambiguity influence the development of a systems thinking mental model?
- B. What thinking strategies do the executives employ to make sense of ambiguous or uncertain situations?

Research Question 2: What are the experiences that provide the scaffolding in developing a systems thinking mental model? (experiences and events)

- A. What role does the executives' experiences and education play in the development of a systems thinking mental model?
- B. What type of events or situation impacts the executives' learning of a systems thinking mental model?

Research Question 3: What aspects of the individual, organizational, and environmental interactions enable executives to learn how to develop a systems thinking capacity? (relationships, systems, and elements)

- A. How do the executives develop their knowledge and decision-making architecture within ambiguous situations?
- B. What elements, influencers, and interactions promote better business outcomes?

Research Design Overview

The exploratory qualitative research design was conducted from the social constructivist viewpoint. The research study design overview was to investigate what is known of a systems thinking mental model and attempt to “discover the important categories of various meaning and to generate further research” (Marshall & Rossman,

2016, p. 78). General questions such as “What is happening? What are the salient themes, patterns, categories or insights of the interview participants? And how are these patterns linked with one another?” (Marshall & Rossman, 2016, p. 78) provided a useful approach to gain information into the cognitive complexities surrounding this topic. Since there is also a lack of academic and practice-based books on how to learn this competency in the workplace, grounding the research in qualitative research methods from the adult learning theoretical foundation may provide this lens with the right focus for greater understanding of “learning as a process to manage complexity, dynamics and feedback loops” (Alhadeff-Jones, 2008, p. 66). Data collection methods included semi-structured interviews, a focus group session, and a demographic questionnaire.

The researcher interviewed 12 executives working in the UAE who have a deep element of ambiguity in their professional positions in order to better understand their thinking patterns as they pertain to a systems thinking mental model. The study examined the participants’ thinking patterns and perceptions of how they manage business ambiguity. This provided a foundation for understanding the elements involved in how they learned to build an intellectual thinking capability through contextual analysis.

The 12 participants were diverse in terms of nationality, work domains, and levels of education. The researcher conducted the data collection using semi-structured interviews with the participants. The researcher also conducted a focus group session of six different participants who work in environments and positions with uncertain and ambiguous variables and had different nationalities, work domains, and levels of education. The aim of the focus group session was to provide additional data points for triangulation for the executives’ interview perspectives. The demographic questionnaire

provided rich data to complement the interview and focus group data in the categories of age, nationality, gender, educational level, and different languages. This demographic analysis served to better understand the participants' perspectives. The interview and focus group participants were selected according to criteria detailed in Chapter III.

As systems thinking principles indicate a holistic view is required to understand the entire system, the researcher employed a 'systems thinking lens' and conducted the research as an exploratory study to gather data on the participants' perspectives, potential world views, and understanding of how their experiences and interactions may help to develop a systems thinking mental model. Mason (2002, as cited in Creswell, 2009) stated, "qualitative research produces holistic understanding of rich, contextual and generally, unstructured, non-numeric data and by engaging in conversations with the research participants in a natural setting" (p. 537). The researcher was able to collect data from the participants' views and knowledge of their reality. The exploratory study's focus was to gain insights and familiarity that may generate new ideas and assumptions of how a systems thinking mental model is learned within business ambiguity.

The methodology included a comprehensive description of these areas to address qualitative research characteristics (Creswell, 2013; Hatch, 2002; Marshall & Rossman, 2010). These characteristics included collected data from the following criteria: (a) be situated in the executives' natural setting; (b) collect data as 'researcher as instrument' to observe behaviors and affective elements; (c) utilize multiple sources of data to ensure; (d) conduct in-depth inductive and deductive analysis; (e) focus on the learning of the participants' meaning of the topic; (f) ensure the design is iterative; (g) conduct reflection

periods; and (h) ensure a holistic approach is used to address the multiple perspectives (Creswell, 2014, p. 186).

Researcher Perspectives

The researcher has more than 25 years of work experience, with over 15 years working in complex adaptive systems and international start-up organizations. The researcher developed an interest in the topic of systems thinking and mental models while working in an international setting with diverse executives and noticed that some executives who had no formal training in systems dynamics were able to navigate the complexity and nuances of business dynamics with greater success than other executives. These observations and behavior patterns provided the interest in the research topic. As such, the researcher's views in organizational design, adult learning and behaviors play an important role in the perceived meaning of the data collected and studied.

Assumptions

The researcher held five assumptions related to the study. First and foremost, there was an assumption of thinking patterns that may align with the premise of a systems thinking mental model in the selected executives. The researcher did not conduct a cognitive assessment to identify the presence of a systems thinking capacity, measure the executives' systems thinking on a predefined systems thinking continuum (Lectica, 2019), or determine the executives' thinking patterns or perceptions prior to the interviews. Based on the limited empirical studies that have identified, measured, or agreed-upon explicit characteristics of systems thinking, the researcher selected the

participants based on the participant selection criteria outlined in Chapter I and detailed in Chapter III; knowledge of the executives' career progression within the UAE; depth and breadth of their professional experiences and projects within their CAS domain; and the researcher's personal knowledge of the executives (if known) that provided an indication of their professional and behavioral ability to manage within complex, uncertain, or ambiguous situations.

The selection criteria provided the baseline criteria for understanding the executives' background, experiences, and context surrounding CAS and ambiguous situations. Knowing the limitations of not having predetermined evidence of executives' thinking patterns and perceptions prior to the interviews, the research purpose was ultimately about seeking to verify, during the interviews, more understanding of systems thinking patterns and behaviors rather than determining measurements of existence. However, the researcher did want to examine the executives' perceptions and behavior patterns and kept the following systems thinking theorists' insights in mind during the interviews. For example, Senge (2011) described in the YouTube video *Navigating Webs of Interdependence* that systems thinking is evident when:

Individuals use the system to leverage different points of view to see different parts of the system, those individuals that embody the term 'collective intelligence', and those individuals that can balance the short and long term strategies to see the big picture, and ultimately can challenge their assumptions and learn to change their mental models.

Additionally, Ackoff (1994a), a pioneer for systems thinking, also did not explicitly state any predefined systems thinking characteristics, but spoke more about the behavior of systems thinkers as those who "seek whole perspectives, rather than trying to understand from the individual parts" (p. 175).

Second, the researcher assumed the participants may not explicitly know or understand the concept of systems thinking and, to a certain extent, may not fully conduct their professional practices by seeing and understanding feedback loops, independencies, or fluid and dynamic agents. However, the researcher sought to understand how each of the executives' perspectives of how they unravel the complexity and ambiguity of their domains would deepen understanding of their mental models through their thinking patterns.

The third assumption was that within the business environment, variables influence relationships and communication patterns, and due to the dynamic nature of the environment, it is difficult to manage a business strategy without using a holistic or systems thinking management style. Beer (1972) stated the real fundamental problem of management is the problem of complexity. Hence, the assumption was that a systems thinking mental model is an ambiguity thinking component, but limited learning frameworks align with this premise.

The fourth assumption stems from the intention to seek more understanding from adult learning theories that provide research insights into the individual, organizational, and environmental experiential learning perspectives. The researcher believed this connection, while complex and unique to each organization, may provide a grounding for how to develop learning, behavioral, social, and structural networks in the workplace that help individuals navigate the learning path towards a systems thinking mental model. There was no framework to follow and Dr. Julia Sloan's (2014) research aligned with the adult learning viewpoint, indicating that executives learned how to tackle strategy through incidental learning activities rather than strategy frameworks or popular models.

The researcher proposed that learning to develop a systems thinking mental model may follow Sloan's research that executives use adult learning concepts, such as informal or situational learning, as the foundational learning method, consciously or unconsciously, to manage ambiguous workplace situations within complex adaptive systems.

The final assumption was that an executive with a diverse background can increase corporate performances (Rock & Halvorson, 2016). This assumption was suggested as mental models are developed through a lifetime of experiences that shape and develop behaviors and mind sets (Kegan, 1984). This diversity of thought may create opportunities for understanding how different backgrounds, levels of education, and experiences can contribute to the development of a systems thinking mental model.

Rationale and Significance of the Study

The criticality of this study is important as global business decision making has become more ambiguous as the technology network has advanced the business footprint on how to seek, share, and understand systems, processes, relationships, and perspectives. Moreover, as the rapid pace of change, interconnectedness, and layers of dependencies increases, Weick (2010) stated it has become increasingly difficult to understand the patterns and cycles of events. The literature posited that understanding more about systems thinking may help executives avoid linear problem solving and analytical processes. Ultimately, Checkland (1985) suggested that executives who rely on cause-effect linear processes and deconstruct the whole into parts may be at a disadvantage as being able to understand the layers of systems, dynamic behaviors, and information can help solve re-occurring or systemic issues. However, there is a literature gap in

understanding how to learn this intellectual thinking competency. The premise of this exploratory study, then, was to explore this problem through the adult learning lens, which gives the current research body a different viewpoint of how this dynamic and comprehensive concept can be more widely understood and utilized.

Developing a systems thinking mental model may be a multifaceted and multilevel construct or a static learning event. Thus, to understand more about this complex cognitive construct, more research was needed to understand the nuances of a systems thinking mental model and the patterns, relationships, inferences, perceptions, and behaviors within the network of systems to understand ambiguity thinking and avoid unintended business consequences. This exploratory study addressed what is known about systems thinking and mental models as well as issues of working within uncertain or ambiguous situations and sought to understand how learning takes place. Situating the research with executives within ambiguous CAS domains helped to understand how the executives operate, navigate, and learn. This qualitative study provided insights into the current setting in the UAE but may also promulgate further research into different landscapes or settings. Essentially, the results of this study should assist in future research to understand how to learn how to develop a systems thinking mental model to manage business ambiguity. The researcher next highlights the summary and key terms.

Summary and Overview

Systems thinking is not a common corporate competency nor is there agreement on how to learn to develop systems thinking, and much less on understanding the components of a systems thinking mental model. Researching this dynamic cognitive

concept may provide valuable insights into how businesses can tap into the field of adult learning to understand how executives learn to develop a systems thinking mental model. Despite a lack of progressive literature, the adult learning lens may provide insights into understanding ambiguity thinking strategies and distinguishing the components, events, situation, behaviors, or multiple levels of environmental framing to point to an ‘experiences learning pathway’ to developing a systems thinking mental model. Moreover, it may help ensure that executives do not fall victim to the best-laid plans in the uncertain future (Steinbeck, 1937).

The next chapter is the literature review and describes the current research and theories on systems thinking, specifically from an adult learning lens, and draws additional insights from two other literature areas: cognitive complexities and relevant learning from experience theories within complex and ambiguous environments. The intent was to understand how learning occurs in ambiguous environments and the thinking patterns or intellectual behavior that enable construction of a systems thinking mental model. Chapter III details the methodology and research design for the exploratory qualitative interviews within the social constructivist paradigm. Following, Chapter IV provides a description of the executives’ CAS domains. Chapter V outlines the research findings and links the narratives from the qualitative semi-structured interviews into a thematic coding of the executives’ perspectives in alignment with various adult learning theories to create a bridge from interview patterns into theoretical insights and academic practitioner opportunities. Chapter VI is a synthesis of the findings as proposed from the literature review and data collection. In Chapter VII, this

exploratory research summarizes the conclusions and offers a set of recommendations for conducting future research.

Key Terms

The terminology used in this study was defined as follows and more comprehensive research on the terms is presented in the literature review chapter.

Ambiguous Environments: Ambiguity can be described as environments that have an “ongoing stream that supports several different interpretations at the same time” (Weick, 1995, p. 91) as well as environments or situations in which “the nature of the problem is itself in question, information reliability is problematic, goals are unclear or conflicting, contradictions and paradoxes appear, and poor understanding of cause-effect relationships” (McCaskey, 1982, p. 93).

Ambiguity Thinking Strategies: The term *ambiguity thinking strategies* provides an organizational operational perspective on how cognitive learning practices may provide context and understanding on how executives can align inexactness, paradoxes, or uncertain situations (ambiguity) within the business context (principles and practice) and the ideal conditions (influencers, elements, interactions and knowledge making architecture) to create an ideal learning pathway to assist in the development of a systems thinking mental model.

Complex Adaptive Systems: These systems involve many components that adapt or learn as they interact. They are defined by “many components and as each component affects, and is affected by, every other component within the boundaries of

the systems such that one cannot appreciate the systems whole by simply examining the parts” (Holland, 2005, p. 1).

Systems Thinking: Systems thinking is the art and science of making reliable inferences about behavior, people, and systems by developing an increasingly deep understanding of the underlying structure and the fluid agents that interact to change the structure (Richmond, 1994). It also involves seeing the behavior of a system change through changing variables and as a “discipline for seeing wholes and seeing interrelationships rather than things and seeing patterns of change rather than snapshots” (Senge, 1990, p. 68).

Mental Models: Mental models involve the cognitive complexity activity of “representing objects, states of affairs, sequences of events, the way the world is and the social and psychological action of daily life. They enable individuals to make inferences and predictions, to understand phenomena, to decide what action to take and to control its execution and above all, the experience events by proxy” (Johnson-Laird, 1983, p. 397).

Systems Thinking Mental Model: This model consists of the cognitive and behavior capacity to reflect on, examine, and adapt perspectives and to seek meaning from dynamic connections, interactions, experiences, and behaviors to determine the ideal decision pathway. A systems thinking mental model may provide more understanding of how to leverage the fluidity of uncertain situations from the individual, organizational, and environmental perspectives to increase learning and collective understanding of how to support positive outcomes.

Successful Executives: These are top-level executives or “elites” operating in the business, academic, or government domain who may hold titles such as CEO, CFO, or President, or hold a position within one reporting line from the highest executive position in the company. The participants can be classified as “elites,” who are defined as those individuals with “power and influence and are considered influential, prominent, and/or well informed in an organization or community and are selected for their in-depth perspectives” (Marshall & Rossman, 2010, p. 158). The executives must have worked in the UAE and in at least two different CAS or positions with ambiguity elements for at least 10 years in total.

Sense making: Sense making is described as the developing set of ideas with explanatory possibilities (Weick, 1995), a “construction of the unknown” (Waterman, 1990, p. 41), and involves “placing stimuli into some kind of framework” (Dunbar, 1981, p. 397; see also Goleman, 1985; Starbuck & Milliken, 1988).

Chapter II

LITERATURE REVIEW

Chapter I provided the foundation for understanding why a systems thinking mental model may be important to develop within complex and ambiguous environments and the learning awareness gap. Chapter II provides the theoretical framework for this study and examines research in three main areas—systems thinking, cognitive complexities, and learning from experience theories—to understand more about the learning perspectives from the individual, environmental, and organizational contexts. The literature review is structured as a learning journey of the main concepts to land on the *systems thinking mental model* concept, which is a blend of the main dissertation concepts and ends the chapter with the systems thinking mental model conceptual framework.

Due to the comprehensive nature of systems thinking within different domains, the literature review focused on studies and research that aligned with cognitive complexities and adult learning theories rather than the plethora of decision science literature that is related to IT, engineering, physics, or complexity philosophy. While each of these areas is still ripe for research, the premise of this study was to understand more about the executives' perceptions and narratives of their thinking patterns that may have

assisted in learning how to develop a systems thinking mental model to manage business ambiguity—essentially, a qualitative exploratory research study focused on the adult learning context as it pertains to the workplace.

The process of searching for the relevant literature included a delimiting exercise in which the following key words were used: systems thinking, mental models, adult learning, ambiguity, complex adaptive systems, and learning from experience. By limiting the search criteria, the researcher was able to focus on the key elements of the identified literature gap. The actual literature search included three main databases and portals: Columbia University, Teachers College online library; Mendeley, a reference management and network database; and Google Scholar. Secondary research areas included internet search, dissertations, books, and journal articles. Considering the depth of systems thinking research and theoretical concepts, an overview of systems thinking is warranted to begin the understanding of how this concept can be a learned mental model. The literature review begins with an overview of the concept of systems thinking.

A Systems Thinking Overview

The concept of systems thinking is a discipline that has emerged and converged within the different decision and complexity sciences spanning from the 1940s. Despite the in-depth research studies regarding systems thinking, it is still a misunderstood concept and the researcher posits that it is an under-utilized business-related cognitive thinking competency. This literature review explores the concepts of systems thinking, mental models, and ambiguity as well as other concepts, such as experiential learning

theories, to provide a baseline understanding of the core constructs that may help explain or describe the development of a systems thinking mental model within ambiguous or CAS environments. Each of these concepts, while broad and complex in itself, provides a holistic framework to begin discussing a systems thinking mental model.

Defining Systems Thinking

Sterman (1989b) defined systems thinking as “the ability to see the world as a complex system, in which we understand that you can’t just do one thing and that everything is connected to everything else” (p. 4). Capra (1996) described systems thinking as “integrated wholes whose properties cannot be reduced to those of smaller parts” (p. 36), while Senge (1990) defined systems thinking as a “discipline for seeing wholes and a framework for seeing relationships rather than things, for seeing patterns of change rather than snapshots” (p. 68). Each definition sought to understand the individual, the organization, and the environmental elements and their dynamic fluidity. Table 1 represents the definitions of key theorists’ systems thinking, as collated by the researcher.

The next section reviews the historical and current literature to provide a contextual framework of the depth and breadth of the systems thinking research to date. The section includes research on how systems thinking originated from the complexity sciences and spans across various disciplines such as economics, decision sciences, engineering, and biology.

Table 1

Author's (2019) Collated List of Key Systems Thinking Definitions

Author	Contextual Definition
Barry Richmond (1994)	Systems thinking is the art and science of making reliable inferences about behavior by developing an increasingly deep understanding of the underlying structure. Systems thinking requires the individual to perceive dynamic feedback within the system itself as being responsible for generating the behavioral patterns exhibited by the system, rather than the exogenous factors we often identify as causes
Russell Ackoff (2004)	A system is never the sum of its parts. It is the product of the interactions of its parts.
Peter Senge (1990)	Systems thinking is a “discipline for seeing wholes and a framework for seeing interrelationships rather than things, for seeing patterns of change rather than snapshots” (p. 68).
Peter Checkland (1999)	Systems thinking is “an epistemology which, when applied to human activity is based on the four basic ideas: emergence, hierarchy, communication and control as characteristics of systems” (p. 149).
John Sterman (2000)	“The ability to see the world as a complex system, in which we understand that ‘you can’t just do one thing’ and that ‘everything is connected to everything else’” (p. 4).
Ludwig von Bertalanffy (1956)	Concepts include open systems theory and equifinality where the same final state may be reached from different initial conditions and in different ways.
Fritjof Capra (1996)	Capra explored living systems and defined systems thinking as “integrated wholes whose properties cannot be reduced to those of smaller parts” (p. 36). “Systems thinking is contextual thinking and since explaining things in their context means explaining them in relation to their environment” (p. 30).

Evolution of Systems Thinking

Stemming originally from the Complexity Sciences in the 1940s, two main Complexity Theories were created: the Systems Sciences that include the General Systems Theory (von Bertalanffy, 1968), and Cybernetics from Norton Wiener (1948). During the 1960s, the main theories developed and created space for further research in the form of the Dynamic Systems Theory from the Systems Sciences stream: Complex Systems Theory (1975), Artificial Intelligence and Cognitive Behaviors from the Cybernetics stream, as well as other intellectual lineages, as per Figure 1.

While the succinct definition of systems thinking and ‘systems theory’ is still deliberated, it is widely agreed that systems thinking evolved from the complexity and cybernetic sciences (von Bertalanffy, 1968). As early as 1941, the concept of cybernetics emerged alongside the General Systems Theory in the late 1940s to manage the consequences of complexity (Capra, 1996; von Bertalanffy, 1968). Building on this theory, cybernetics, invented by Norton Wiener, proposed the science of communication and control theory, grounded in the development of information theory. The theory was pivotal as it introduced systems science, engineering, and computer technology as a means to extend human capabilities and introduced the concept of ‘feedback’ to describe how a system can operate by adapting itself in its environment (Wiener, 1948).

The concept of feedback or feedback loops was instrumental in determining the root cause of complex problems (Wiener, 1948). Beer (1979) stated the discovery of cybernetics was about the fundamental principles of behavior of all systems under control. Additionally, Beer (1972) developed the cybernetic Viable System Model (VSM) to understand the complexity of vast information processing demands to respond to

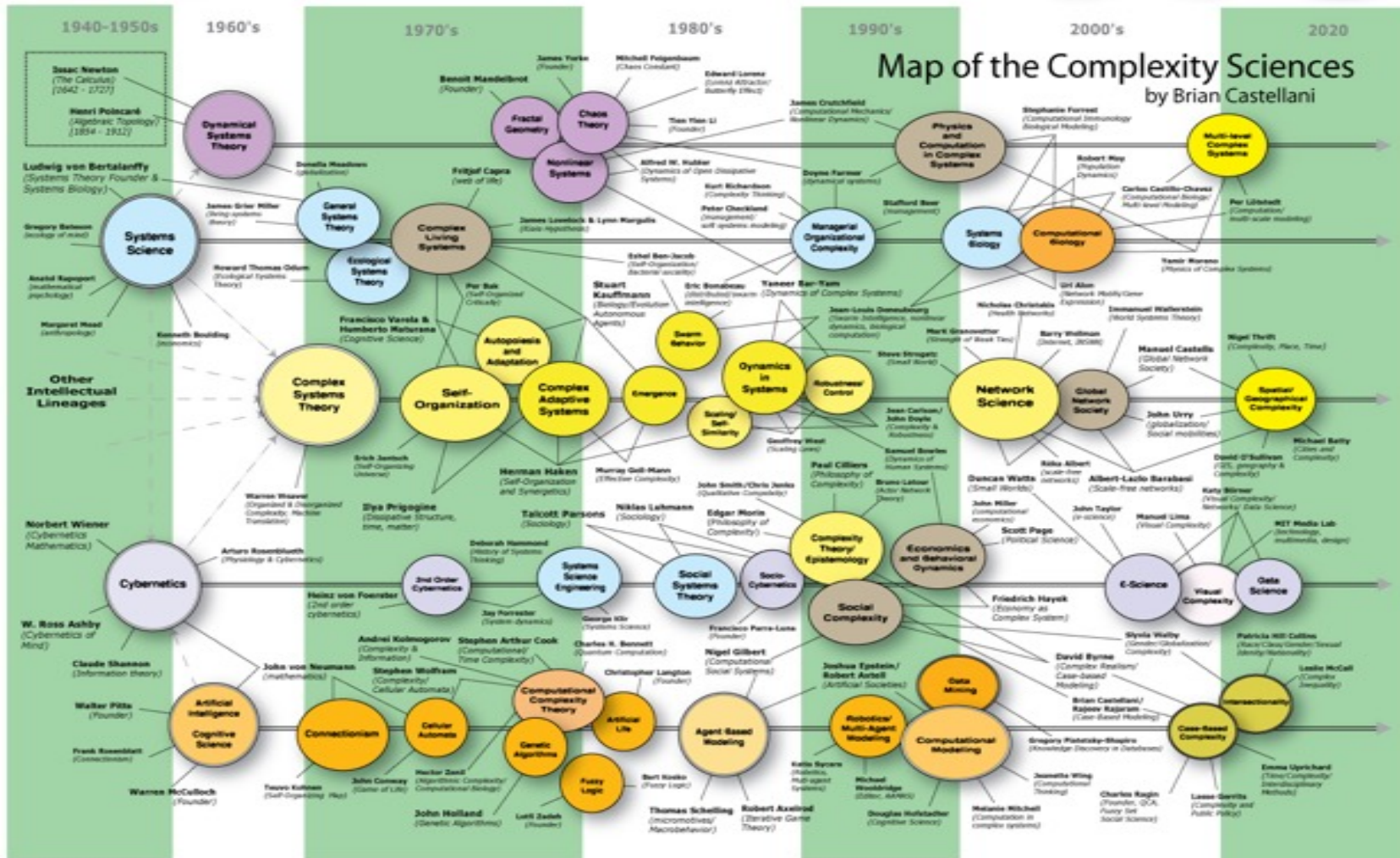


Figure 1. Castellani's (2013) map of the complexity science

increasingly complex situations within open systems. This concept helped to meet the demands of the fluid environment and assisted in learning more about the changes that occurred through the complexity and the adaptive behavior patterns. Holland (1995) described complex adaptive systems that have “many components that adapt as they learn as they interact” (p. 1). The concept of complex adaptive systems was developed as a progressive model to understand more about the chaotic dynamics in systems behaviors (Dooley, 1997).

Complex Adaptive Systems

Dooley (1997) stated that although most of the principles of complexity theory originated in the physical and natural sciences, Gell Mann (1995) saw the social and behavioral sciences as a lens for broader potential. By adopting a wider perspective to understanding systems thinking into organizations, the systems were understood to also blend human responses, behaviors, and informal networks of people who interact and influence the organizational structure. Thus, complex adaptive systems are defined as global companies, multinationals, and conglomerates that have fluid components, dynamic relationships, and interconnected systems, and include domains such as healthcare, the military, and government agencies (Holland, 2005). In order to operate, the nature of complex adaptive systems seeks to understand the changing decisions, information, and knowledge architectures within the systems, rather than trying to fully control the change.

A balance of control and fluidity is required within CAS. For example, Dooley (1997) suggested that inadequate connections make it difficult for the system to coordinate adaptive responses to internal or external changes, but also stated that

excessive connectivity affects networks and can suffer from operational issues when the number of connections per node exceed a threshold level. Another important feature of CAS is the human cognition. Stadler and Kruse (1995) identified ‘meaning’ as an order for high-level brain processes and provided insights into links to the individual and organizational patterns. Additionally, the premise of feedback loops is important as negative or positive feedback disrupts patterns of thought or action. March (1994) described this as the “*competency trap*” when a structure or individual has little incentive to learn a new method because the status quo is deemed suitable. Executives who can manage the dynamic and complex environments may be able not only to expand the boundaries of their mental models and develop cognitive tools to understand the structure of complex systems, but also to understand that systems can create their own behavior and cause cyclical operational errors (Sterman, 1989a).

In summary, systems thinking has evolved through a multitude of theories along complexity theories and includes New Cybernetics (Geyer & van der Zouwen, 1978), Complex Adaptive Systems (Holland, 1992), Emergence (Lewes, 1875), Soft Systems Thinking and Managerial Organizational Complexity (Checkland, 1985), Organizational Learning (Senge, 1990, 1994), and Neuroscience (Rock, 2009).

The Systems Thinking Learning Lens Overview

Wide-angle lens or *holistic view* are terms that help to describe a systems thinking requirement; however, it is more than taking a ‘30,000-meter overview.’ The competency is to focus on the whole rather than on the parts and as a way of understanding complex situations by learning more about the changing relationships within the process (Mele, Peis, & Polese, 2010), or by analyzing a phenomenon and not simply the sum of

elementary parts (Holland, 2005). Table 2 provides the researcher's collated details of the key concepts of systems thinking theorists.

Table 2

Author's (2019) Collated List of Systems Thinking Theorists and Key Concepts

Complexity Concept	Key Thinkers	Key Ideas	Key Concepts
General Systems Theory (GST)	von Bertalaffy (1968)	Defines systems as a complex of interacting elements. Introduces 'systems' as a new scientific paradigm contrasting the analytical, mechanical paradigm, characterizing classical science (von Bertalaffy, 1956).	Open Systems Theory
Cybernetics	Wiener (1948) Beer (1972)	A theory of behavior of living organisms and machines and field that is specifically concerned with control and communication in systems. Beer stated cybernetics represents an interdisciplinary study of the structure of regulatory systems of how actions by a system cause changes in the environment that are understood by the system itself in terms of feedback and creates sub-systems and supra-systems (Beer, 1971).	Computer and Information Theory
New Cybernetics	Geyer & van der Zouwen (1978)	Views information as constructed by an individual interacting with the environment or to society.	Communication between systems
Emergence	Lewes (1875)	Properties of the 'system as a whole' rather than properties that can be derived from the properties of the system components. Emergent properties are a consequence of the relationships among system components and a formation of collective behaviors.	Collective behaviors and properties
Soft Systems Methodologies	Checkland (1985, 1999)	Interpretative in nature (as opposed to functionalism of hard systems) and deals with the complexities of human affairs and management issues as a 'process of enquiry.'	Emergence, hierarchy, communication and control
Complex Adaptive Systems	Holland (1992, 1995, 2005)	Defined by a large number of components and each component affects, and is affected by, every other component within the boundaries of the systems, such that one cannot appreciate the systems' whole by simply examining the parts.	Focus on the whole rather than parts

Executives who learn to approach problems from different viewpoints leverage the context, paradoxes, tensions, and uniqueness of certain elements, which may also include the participants' personal beliefs and assumptions and allow new and creative ways to tackle messy or re-occurring issues. Knowing that the systems thinking space is largely a cognitive intellectual capability amplifies the need to learn more about the influences, experiences, and behaviors that explore the individual's perceptions and the interactions within the different environments. Noting that the environment and certain businesses are complex systems, individuals and their behaviors are also part of the system bound by the "interrelated actions as well as the individual and collective understanding" (Senge, 1990, p. 159).

The adult learning lens may be an important viewpoint as certain theories emphasize complex, constructive, and reflective views for understanding how individuals learn from experience within different environments and contexts. The adult learning lens provides a context for examining the influence of environmental factors and is a salient point to keep in mind when discussing ambiguities and systems thinking, as keeping the cognitive process at the holistic level and focused on the entire spectrum rather than reducing the complexity to the individual parts is an important fundamental systems thinking point. In conducting the Beer Distribution study with 192 subjects and 48 trials over a 4-year period with MIT undergraduate students, graduate students, and executives from a major computing firm for the simulation, Sterman (1989a) incorporated experiential learning mechanisms such as role playing, simulation, and reflective activities to develop a systems thinking capacity. Noting this foundational learning concept, the Sterman study pointed to John Dewey, an academic philosopher who

provided extensive literature on education and experience and posited that experiential learning is the process whereby knowledge is created through the transformation of experience (Kolb, 1984, p. 41).

The Beer Distribution Game results showed that performance deteriorates rapidly when more levels of complexity were introduced, and that learning is weak and slow even with repeated trials, and unlimited time and performance incentives (Sweeney & Sterman, 2000). Sweeney and Sterman indicated that heuristics or ‘rule of thumb’ within the Beer Distribution Game produced suboptimal results. However, the participants gained more knowledge during the ‘after game’ interviews rather than from the game itself, as the participants reflected on the system dynamics, process, and outcomes. The study indicated the participants learned that an ‘open loop’ (external) arose from the environment and they believed that improved performances would be achieved from understanding the external environment rather than just solely from the management policies (‘closed loop’ internal).

Sterman (1989a) also stated the need for feedback, which is not ‘verbal feedback’ but the “feedback from changes in the environment, in the conditions of choice, which are caused, directly and indirectly, by the person’s past actions” (p. 22). While the research did not focus specifically on adult learning concepts, it did provide insight into the underlying pattern of how a systems thinking mental model may be developed and the mechanisms needed to generate post-experience learning insights, with holistic thinking, dialogue, and reflection practices being introduced.

Similarly, a study by Davidz and Nightingale (2008), entitled “Enabling systems thinking to accelerate the development of senior systems engineers” and a subsequent

article in the *Journal of Systems Engineering*, was conducted in the aerospace domain in which 205 interviews were completed with 10 host companies. The study focused on the position of systems engineers and the overall study was framed on how to develop 'systems thinkers.' The three key research questions were: (a) What are the enablers, barriers, and precursors to the development of systems thinking in engineers? (b) How do senior systems engineers develop systems thinking? and (c) What are the mechanisms that develop systems thinking in engineers? (p. 4). The research proposed five systems thinking characteristics: (a) componential, (b) relational, (c) contextual, (d) dynamic, and (e) model. The research study was interesting to review for the present study's purposes because experiential learning was identified as a key step in the development of systems thinking. The study's question "What were the key steps in your life that developed your systems thinking abilities?" resulted in 'work experiences' being cited by 139 of the participants (69%), while 95% of the expert panelists cited 'work experiences' as the key step in the development of systems thinking (Davidz & Nightingale, 2008, pp. 134).

An additional study was completed in the healthcare domain, which is considered a complex adaptive system. The study "Apply systems thinking to public health leadership" was conducted via survey and interviews with 63 health officers and health department executives. The question asked was "What are the system features of local public health leadership problems and decisions? The purpose was to identify the most important problem the participants faced in their work "at that point in time" (Lammers & Pandita, 1997, p. 39). The study aligned with Senge's Organizational Learning pillars and used questions that tried to identify several features of the problem and what barriers they faced to solve the problem (Lammers & Pandita, 1997). The findings classified

the responses into eight categories: (1) budget, (2) programming, (3) managed care, (4) disease control, and (5-8) various aspects of staffing (Lammers & Pandita, 1997). The interesting finding was that the responses were mainly related to external or third parties and the participants listed over 40 different agencies with whom they interacted (Lammers & Pandita, 1997). This is part of the systems thinking spectrum and the need to look outside our own domain for known and unknown knowledge to increase decision quality.

Adding to the body of systems thinking conceptual frameworks, Cabrera (2006) developed the DSRP model, indicating that systems thinking is learned through understanding of (a) distinctions, (b) systems, (c) relationships, and (d) perspectives, and Cabrera worked continually to build this competency into school curricula. Cabrera posited that the four patterns underlying all cognition whereby *distinction* is comprised of two concepts in question: *systems thinking* is taking a systemic view of the world to identify parts and wholes; and *relationships* are characterized as action and reaction or 'cause-and-effect' and *perspectives*, which is the thinking or mental models of systems thinking.

Literature points to the development of systems thinking understanding within K-12 education curricula (Sweeney & Sterman, 2000) and business application through organizational theory developments (Senge, 1990). While the concept of systems thinking is part of the organizational development lexicon, it still fails to reach a full understanding as a learned leadership competency, despite systems thinking management experts positing that business and leadership practices must change to be effective in uncertain environments (Ackoff, 1994b; Forrester, 1994; Senge, 1990). Recognizing the

gap, Cavaleri and Sterman (1997) conducted a study of a U.S. insurance firm and findings showed that subjects reported greater awareness of their thinking and changes in their behavior when systems thinking interventions were implemented. Adult learning systems thinking visual models are also beneficial for ‘seeing’ how systems thinking occurs, similar to how simulations, causal maps, and workflow diagrams help to visualize the systems thinking decision science principles, processes, feedback loops, and interactions.

Exploring peripheral insights that blend sense making, perspective taking, and influencing past experiences or events that formulate understanding and assumptions may assist in uncovering cognitive and system behavior patterns (Argyris & Schon, 1978; Weick, 1995). Essentially, businesses should seek insights into the ideal cognitive learning pathways to understand ambiguity thinking strategies to a larger extent.

Collated Systems Thinking Concepts

Defining systems thinking is challenging. Through review of the various theorists, the literature suggests that systems thinking can be viewed holistically through characteristics that create a common thread throughout the research. Table 3 collates these characteristics to gain a high-level understanding of the historical and recent research on systems thinking. By keeping high-level concepts in mind, researchers can seek to understand how systems thinking influencers, elements, and interactions within the individual and environment spheres can contribute to ambiguity thinking strategies. By understanding CAS core concepts, one is able to “make meaning” of the system (Mezirow, 2000), to effectively make sense of the variables, perceptions, feelings, and intentions to make insightful decisions and potentially avoid becoming a victim of the

complexity and mental demands that may place them “in over their heads” (Kegan, 1998, p. 12).

Table 3

Author's (2019) Collated Systems Thinking Theorists' Concepts

System Thinking Theorists	Systems Thinking Collated Concepts
Richmond	1. Wholes rather than parts
Checkland	2. Feedback loops
Holland	3. Open systems
Sweeney and Sterman	4. Dynamic behavior
Senge	5. Systems structure as the cause of behavior
	6. Non-linear relationships
	7. Interconnections/interrelationships
	8. Dynamic systems and patterns of change

The next section of the literature review considers mental models, specifically the research on complexity and uncertainty-focused mental models. Executives may be posed to reap many benefits from understanding more about the concept of a systems thinking mental model and identify the ideal factors and considerations taken when managing and learning within complex adaptive systems.

Mental Models: Understanding Cognitive Complexities

While having diversity of thought may promote creativity and innovation, corresponding issues can also arise, such as challenges in understanding different perceptions or interpretations of the same event. Essentially, the literature provides the framework for understanding how diversity of thought and behaviors may help to manage business ambiguity.

Ambiguity

The term *ambiguity* is frequently used when researching cognitive complexities. As Cabrera (2006) stated, “an in-depth review of systems thinking research shows significant ambiguities of what constitutes systems thinking” and “there are only a few empirical study designs that promulgate researching these ambiguities in the field of systems thinking” (p. ii). Further, Checkland (1999) stated that “real world complexity is problematic due to the multiple, ambiguous and conflicting alternatives” (p. 52), while Weick (1995) described ambiguity in *Sense Making in Organizations* as an “ongoing stream that supports several different interpretations at the same time” (p. 91). When defining ambiguity for mental models, Martin (1992) argued that “ambiguity is perceived when a lack of clarity, high complexity, or a paradox makes multiple explanations plausible” (p. 92). To further explore the ambiguities within complex adaptive systems, the U.S. Army War College introduced the term *VUCA*, which describes environments that are (a) volatile, (b) uncertain, (c) complex, and (d) ambiguous. In the *VUCA* context, ambiguous is described as “the mixed meaning of conditions; cause-and-effect confusion and no precedents exist; and face the unknown unknowns” (Bennett & Lemoine, 2014, p. 553).

To address these issues, the business community has developed considerable interest in understanding cognitive complexities and ambiguous business environments as it has become progressively difficult for businesses to tackle unanticipated events and define the influencers that generate unintended business consequences. To help define the context of ambiguous situations, Table 4 outlines McCaskey’s (1982) 12 characteristics of ambiguous workplace situations.

Table 4

McCaskey's (1982) Characteristics of Ambiguous Changing Situations

Characteristics	Description and Comments
Nature of problem is itself in question	“What the problem is” is unclear and shifting. Managers have only vague or competing definitions of the problem. Often, any one ‘problem’ is intertwined with other messy problems.
Information (amount and reliability) is problematical	Because the definition of the problem is in doubt, collecting and categorizing information become a problem. The information flow threatens either to become overwhelming or to be seriously insufficient. Data may be incomplete and of dubious reliability.
Multiple value orientations	For those data that do exist, players develop multiple, and sometimes conflicting, interpretations. The facts and their significance can be read several different ways.
Goals are unclear, or multiple and conflicting	Managers do not enjoy the guidance of clearly defined, coherent goals. Either the goals are vague, or they are clearly defined and contradictory.
Time, money, or attention are lacking	A difficult situation is made chaotic by severe shortages of one or more of these items.
Contradictions and paradoxes appear	Situation has seemingly inconsistent features, relationships, or demands.
Roles are vague, responsibilities are unclear	Players do not have a clearly defined set of activities that are expected to perform. On important issues, the locus of decision making and other responsibilities is value or in dispute.
Success measures are lacking	People are unsure what success in resolving the situation would mean, and/or they have no way of assessing the degree to which they have been successful.
Poor understanding of cause-effect relationships	Players do not understand what causes what in the situation. Even if sure of the effects they desire, they are uncertain how to obtain them.
Symbols and metaphors used	In place of precise definitions or logical arguments, players use symbols or metaphors to express their point of view.
Participation in decision making fluid	Who the key decision maker and influence holders are change as players enter and leave the decision arena.

Systems Thinking and Mental Models

“How do we think?” is a simple question that leads to various complex answers. Johnson-Laird (2005) stated that mental models are “the thinking that enables us to anticipate the world and choose a course of action based on our internal manipulations of these mental models” (p. 185). The concept of mental models was developed by Kenneth Craik (1943) and is based on the construction of the concepts “*explanation and reasoning*” (p. 195, also see Johnson-Laird, 1983). Mental models have also been described as “deeply ingrained assumptions, generalizations or even pictures or images that influence how one understands the world and how we take action” (Senge, 1990, p. 8). The premise of understanding what mental models are and how a systems thinking mental model is developed may help executives understand their own thinking patterns, beliefs, and assumptions as they relate to the changes that occur (some unexpected) within complex adaptive systems to help anticipate or reduce systematic or re-occurring errors. Systems thinking training in trauma centers helps to ensure that holistic thinking methodologies are used to better address the multiple variables and interrelationships that affect the individuals and the environment (Coffey, 2009). DeMattos, Miller, and Park (2012) described the cognitive aspect of systems thinking as “*perceptual richness*,” as one would need the ability to anticipate the conditions and various alternative steps during constant change.

There are many different types of mental models: logical and causal mental models (Johnson-Laird, 1983), in which “causal loops is a way of understanding the links between things by identifying the positive and negative correlations” (p. 54); analogical reasoning, which promotes activation of prior knowledge and provides opportunity to

transfer knowledge across domains (Gentner & Gentner, 1983; Gentner & Whitely, 1997); and models of inference (Johnson-Laird, 1983), when people use their world knowledge and cues to develop a mental model of the most likely interpretation.

Additionally, some mental models are vital for understanding ambiguity and the environment to a higher degree. Consider the phrase “My statement was taken out of context” posits this common complaint explains why perspective taking is required when discussing systems thinking and complex adaptive systems because the mental models of the situation enable one to make inferences and link the intent to the outcome through a causal mental model (Green, 1996, pp. 4). Thus, additional mental models based on context of the situation are relevant to explore, such as the model theory of deduction (Johnson-Laird, 1983); reasoning under uncertainty (Johnson, Byrne, & Schaeken, 1992); and cognition of social agents (Byrne & Whiten, 1988), which is to explain the “pressures to understand and predict the behavior of others in a social group and is critical to the evolution to the human mind” (Green, 1996, p. 120). Vygotsky’s (1978) research is perhaps most influential in understanding that “individual concepts derive from the internalization of the socially structured activities and experiences” (p. 7). Green also suggested that we are “embedded in social settings and the biological based on our cognitive and affective worlds reflect this” (p. 120). Acknowledging that mental models are based on previous knowledge and that context matters, it would be important to understand how perceptions are created from information and knowledge within the social constructivist paradigm to provide insights into a systems thinking mental model.

Sense Making and Perceptions

As far back as Plato's fable "The Allegory of the Cave," there are philosophical underpinnings of how human perceptions and mental models are developed. Plato claimed that "knowledge is gained through the senses and is no more than an opinion"; it is up to the person to decide what his or her reality of knowledge is, what the truth is, or to determine if it is just a shadow that is cast upon the wall (International Plato Society, 1989). The Allegory of the Cave fable is rich with interpretations and speaks to our ability to create our own world views and mental models through experiences, knowledge, and perceptions.

The concept of sense making literally means "making sense" (Weick, 1995, p. 4) and has been described by Meryl Louis (1980) as "a thinking process that uses retrospective accounts to explain surprises" (p. 4). Louis further explained that "sense making can be viewed as a recurring cycle comprised of a sequence of events occurring over time. The cycle begins as individuals form unconscious or consciousness anticipations and assumptions, which serve as predictions about future events" (p. 4). Weick (1995) stated that people try to make sense of situations by putting the context into a framework (Dunbar; 1981; Goleman, 1985, pp. 197-217), thus coining the phrase "frames of reference" (Weick, 1995, p. 102). However, as described by Sloan (2014), frameworks or formatted strategic principles may not be that useful when developing strategies and even less so when faced with operational surprises, interruptions in understanding, or unanticipated events (Weick, 1995, p. 45). Cognitive theorists have stressed that sense making is the social construction of the elements that must be

considered to understand population ecology, diversification strategies, group dynamics, or personnel selection (Weick, 1995).

A review of Weick's sense-making properties in Table 5 helps to distill the mental models required to understand ambiguity thinking strategies to a higher level. Seeking to build understanding on this intellectual thinking capacity need, Weick (1995) focused on the concept of "sense making" that focuses on "perceptions, properties of the environment, structures of the organization and equally important, the dispositions of the individuals" (p. 85). Supporting this premise, Huber and Daft (1987) stated that "information load, complexity and turbulence require an enhanced cognitive focus, as due to an increase in complexity overload, people will tend to ignore important elements" (Weick, 1995, p. 85). Systems thinking and sense-making properties may help to augment the mental models required and be key components of understanding more about 'ambiguity thinking' strategies within CAS.

Context Matters

Lewin, a German American psychologist from the early 1900s, suggested that neither nature nor nurture alone shapes an individual; rather, it is the interaction of both (Coghlan & Claus, 2005). Lewin (1936) developed the formula $B = f(P, E)$, in which behavior is a function of the interactions between the person and the environment. The roots of Lewin's research were based in Gestalt Theory and he posited that "behavior is determined by an individual's situation and individuals can behave differently according to the way in which tensions between perceptions of the self and of the environment were worked through" (p. 444).

Table 5

Weick's (1995) Seven Properties of Sense Making

Grounded in Identity Construction	It is who we understand ourselves to be in relation to the world around us. "The recipe is a question about who I am as indicated by discovery of how and what I think."
Retrospective	We shape experience into meaningful patterns according to our memory of experience. "To learn what I think, I look back over what I said earlier."
Enactive of sensible environment	The action and learning to inform further action. "I create the object to be seen and inspected when I say or do something."
Social	Meanings created from conversations and relationships. "What I say and single out and conclude are determined by who socialized me and how I socialized, as well as by the audience I anticipate will audit the conclusions I reach."
Ongoing	Dealing with the reality that employees must act and respond as things continually change. "My talking is spread across time, competes for attention with other ongoing projects, and is reflected on after it is finished, which means my interests may already be changed."
Driven by plausibility rather than accuracy	The credible stories that the group makes of salient cues and ongoing events within the social context. "I need to know enough about what I think to get on with my projects, but no more, which means sufficient and plausibility takes precedence over accuracy."

This premise is predated by John Donne, a philosopher who wrote "no man is an island entire of itself" in a poem in 1624, thereby describing that all mankind is connected. Donne (1959) understood the larger world to be a live, dynamic, and interrelated system. His phrase "every man is a piece of the continent" indicates that man is a part of a larger system, and Donne's response is to make sense of the whole in its natural context. Donne's philosophical perspective of the law, academia, and the church can help modern-day executives elicit clues from systems thinking and mental models as

they pertain to their environment and perceptions; in doing so, they can find the right learning vehicle and medium to propel new insights by continually scanning the environment for learning and knowledge opportunities.

As Kaufman and Kaufman (1993) explained, within complexity, the higher the number of interactions, the harder it is to predict the systems' behavior. In the corporate world, problems are abundant and perceptions are someone's reality. Understanding more about assumptions and bias, which may be obstructions to learning, may help executives gain new perspectives.

Key ideas from the social influence theory (Kelman, 1958) provide a framework to explore how an employee's emotions, opinions, or behaviors are affected by others and are salient points to keep in mind. Additionally, Bandura's (1977) social learning theory proposed that "behavior is learned from the environment through the process of observational learning" (p. 73), while Bandura's (1989) social cognitive theory indicated "personal agency within the structure of self-regulatory systems plays a large part in cognitive, vicarious, self-reflective and self-regulatory processes" (p. 1175), which support other systems thinking characteristics.

Lewin (1951) deepened our understanding of groups, experiential learning, and action. For example, the Stanford Prison experiment was a powerful and disturbing example of how understanding behaviors in difference environments are important in the social-organizational realm. The Stanford Prison experiment was based on a group of Stanford students volunteering for a 2-week experiment in the basement of Stanford University, in which they were separated into two groups: guards and prisoners. The premise of the study was to conduct learning through the "activity of role playing and

simulation” (Taylor & Marienau, 2016, p. 221). However, the ensuing experiential learning study was cut short when it became evident that both prisoners and guards experienced psychological difficulties within their new environment (the mock prison), and the roles they played created increasingly powerful behavioral changes that caused psychological distress in certain participants. The experiment was pivotal learning for understanding people, behaviors, and the environment. As such, behavioral theorists help to provide the cognitive scaffolding to understand how executives learn experiences from individual, organizational, and environmental levels which may help to develop a systems thinking mental model.

The following two adult development theories provide more information regarding cognitive complexity and human development. First, Dawson (1998) built upon Fischer’s seminal work and conducted extensive research on cognitive complexities by developing multiple assessments to build skills for ‘thinking and learning’ (Lectica, 2019). Fischer (1980) illustrated the learning sequence, the actual pathways through which people learn complex concepts and skills through an image that shows different ways of thinking and how they progress through tiers and levels, as illustrated in Figure 2. The image provides a visual of the hierarchical complexity integration in which #6 denotes the skills/lectical levels as a single representation (21 months old), #7 is the representational mappings (4-5 years old), #8 is the representational systems (7-8 years old), #9 is a single abstraction (10-11 years old), #10 is the abstract mappings (14-15 years old), #11 is abstract systems (22+ years old), and #12 is deemed single principles (26+ years old) or Ph.D. + level (Lectica, 2019).

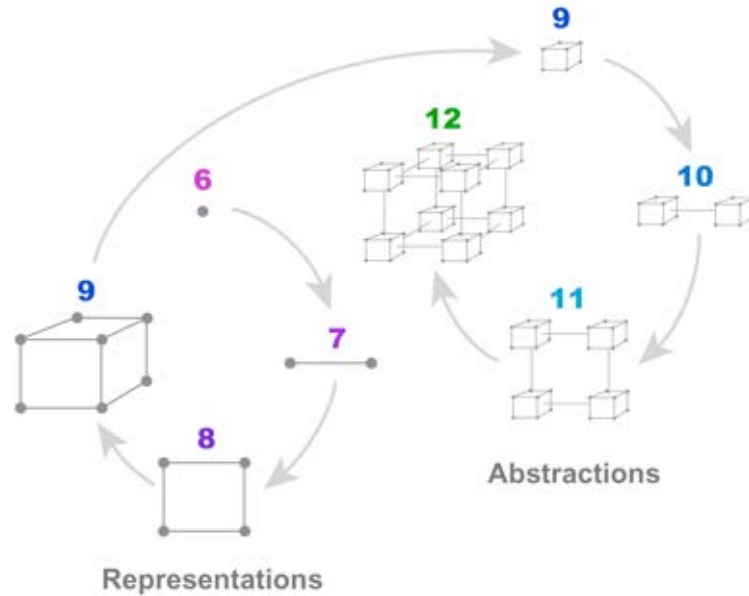


Figure 2. Dr. Kurt Fischer's (1980) Skills Scale

Second, Bronfenbrenner's (1994) Ecological Systems Theory explored the five levels that can influence human development, as Bronfenbrenner believed that a person's development was affected by everything in his or her surrounding environment and the experiences within those spheres and knowledge can be derived from the combination of experience and gained knowledge. The Bronfenbrenner (1994) Ecology Model illustrates how human development can occur within the environment and the evolving interaction within the five nested environment systems: (a) individual, (b) microsystem, (c) mesosystem, (d) exosystem, and (e) macrosystem, as illustrated in Figure 3. The premise of the model states that the ecological environment is conceived as a set of nested structures and the different environment nests provide the individual with different development influences (Drockrell & Messer, 1999, p. 139).

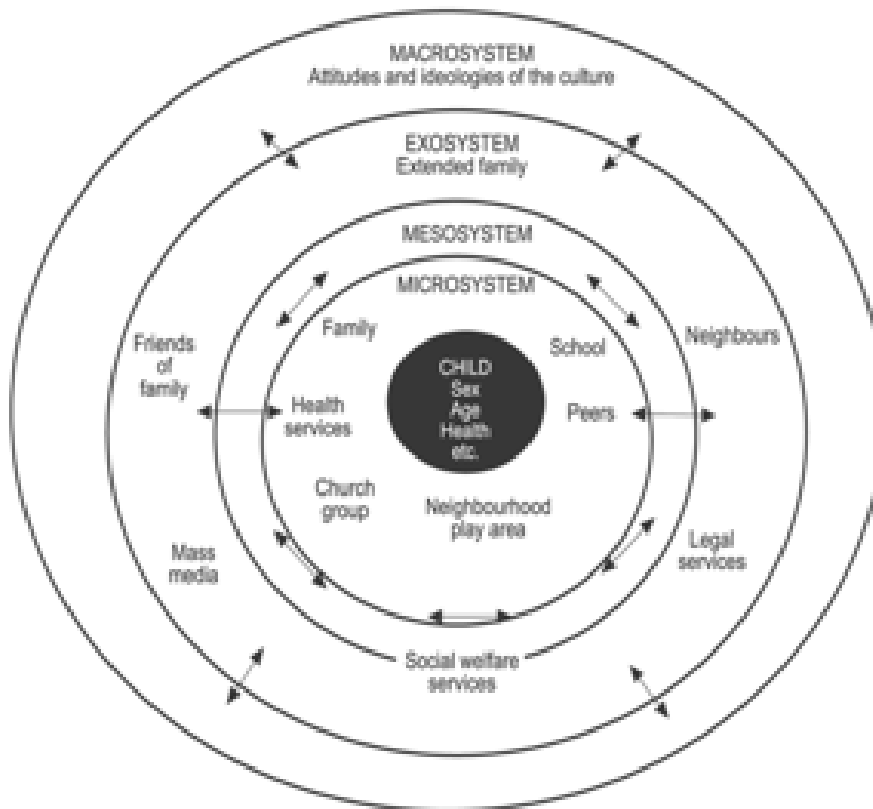


Figure 3. Bronfenbrenner's (1994) ecology model

This adult development model was instrumental in propelling further research into how children grow and develop from experiences in different ecological environments. Examples of this child development concept help explain how two siblings living in the same microsystem and mesosystem can develop differently if one of the siblings has different experiences and interactions through different neighborhood activities and relationships from the exosystem and macrosystem environments.

Neuroscience Influencers

Additional theories from neuroscience help to synthesize the holistic lens as human ecology is also a complex system that is primed for further exploration to understand more about a systems thinking mental model. For example, the human brain

is a “social organ and organizes prior experiences in ways that enables an individual to revisit and reconsider them, thus gaining the benefits of hindsight, specifically reflection, for learning” (Taylor & Marienau, 2016, p. 215). The brain is also hardwired to understand feedback, a systems thinking foundational element, in unique ways. Taylor and Marienau (2016) stated that “positive and negative feedback and our response to it can create stress, anxiety, fear or happiness” (p. 228). The affective elements may be explored within a systems thinking mental model as complex adaptive systems and ambiguous situations involve corporate financial and performance implications, and the executives’ ability to manage their emotions and behaviors are important factors to consider.

Rock (2009) stated that “neural connections can be re-formed; new behaviors can be learned and even the most entrenched behaviors can be modified at any age” (p. 7). The psychological and neurological reactions are “directly and profoundly shaped by social interactions” (p. 7). Organizations can seek to understand neuroscience elements to a larger degree as integrating ‘mindful attention’ principles (Rock, 2009) and can create a wide learning path as organizations can develop initiatives that enable executives to be mindful of the patterns of their thoughts and feelings as they work towards developing greater self-awareness and reflective practices to develop cognitive ambiguity thinking practices. Knowing that Ebbinghaus’s Forgetting Curve hypothesized that the “speed of forgetting will increase when physiological factors such as stress and lack of sleep are present” (Loftus, 1985, p. 400), it is important to understand how affective elements may impact the development of a systems thinking mental model.

Collated Mental Model Concepts

Executives working in complex adaptive systems have challenges; ‘sense making’ of a plethora of corporate information is difficult because system thinking requires understanding of context to see the situation through our perceptions, beliefs, and experiences to make meaning of an event or situation and understand the cause and effect of variables within a fluid and dynamic situation. Table 6 collates the mental models and systems thinking concepts.

Table 6

Author’s (2019) Collated Mental Models and Systems Thinking Commonalities

Theorist	Key Concepts	Systems Thinking Commonalities	Collated Commonalities
Craik (1943)	Explanation and reasoning	Dynamic behavior Feedback loops	
Johnson-Laird (2005)	Causal loops, linkages, identifying positive and negative correlations	Feedback loops Open system Non-linear relationships System structure as the cause of behavior	1. Beliefs 2. Sense Making 3. Reflection
Senge (1990)	Deeply ingrained assumptions, generalizations, or even pictures or images of how one understands the world and how we take action	Wholes rather than parts Open system Interconnections/ interrelationships	4. Assumptions 5. Social constructs 6. World views
Weick (1995)	Seven principles of sense making that address: identity, retrospective, environment, social, outgoing, plausibility	Dynamic behavior Systems structure as the cause of behavior Open system	

Pervasive ambiguity in organizations means that most of what we know about events comes from interpretations, and collective agreement is difficult to achieve as our various mental models, background, and experiences increase decision-making complexity (March & Olsen, 1989). Additionally, building the capacity to interpret the uncertainty may be beyond the limitations of socialized consciousness (Kegan, 1994). The next section explores the interrelationship between the individual, the organizational, and the environmental learning nexus as making sense of our world, workplace, and individual interactions is part of our ambiguity thinking dilemmas.

The Individual, Organizational, and Environmental Learning Nexus

“Learning in adulthood is an intensely personal activity—and is shaped by the context of adult life and the society in which one lives” (Merriam, Caffarella, & Baumgartner, 2007, p. ix). This phrase frames the depth and breadth of adult development and learning theories as they pertain to learning within social context, relationships, behaviors, background, and perceptions. Adult learning can be broadly defined as the acquisition of new knowledge, skills, attitudes, behaviors and values through experience, practice, study, or instruction; simply stated, learning is a change in behavior (Illeris, 2002; Merriam et al., 2007; Ormrod, 1995). Thus, learning can occur at the individual, organizational, and environmental level to recognize and respond to cycles of change.

The term *learning from experience* has been used interchangeably within the literature with the concept of *experiential learning*. While the two concepts have many similarities, this study focuses on the connection of ‘learning and experience’ from informal learning situations, rather than from formal classroom learning events. The

delineation is purposeful to capture the ways in which individuals learn of a systems thinking mental model through informal interactions, connections, cognitive awareness, and concrete experiences.

Experiential Learning

The origin of experiential learning can be traced back to the philosophical school of pragmatism and progressivism, where the roots of the concept were developed to foster creativity, stability, and individualism (Dewey, 1938). Dewey (1938), the philosopher of democracy and education, stated there are two essential components of learning from experience: experience of the learner and critical inquiry. Knowing this, systems thinkers must be able to learn by doing, learn from others, learn through situations, learn from community, learn from behaviors, and find the importance of context to query to be able to develop a systems thinking mental model.

Dewey (1938) further stated that to “learn from experience, the experience must incorporate two principles: continuity and interactivity” (Merriam et al., 2007, p. 163). The principle of continuity of experience means that every experience takes up something from before and modifies it in some way. Moreover, the “interaction of experience is what takes place between the individual and what, at the time constitutes the environment” (p. 163). The concept of ambiguity thinking strategies poses interesting viewpoints and challenges as executives must be able to cognitively absorb the two principles of continuity and interactivity to understand information patterns, social systems, behaviors, relationships, and interactions, and use myriad knowledge constructs to understand these complexities to make informed quality decisions. Dewey (1938) recognized that awareness, thus stating that learning is in relationship to the phenomenon.

Tara Fenwick (2000) took on a complex and reflective view of adult learning and sought to define alternative experiential learning perspectives based on cognition within complex environments. Fenwick described in *Perspectives on Cognition* different perspectives of experience, truth, knowledge, and meaning making and provided five classifications of complexity perspectives: (a) Reflection, a constructivist perspective; (b) Interference, a psychoanalytical perspective based on Freudian roots; (c) Participation, from perspectives of situated cognition; (d) Resistance, a critical cultural perspective; and (e) Co-emergence, from the enactivist perspective stemming from neuroscience and evolutionary theory.

Fenwick (2000) stated the Reflection constructivist perspective is “based on how individuals perceive experience, interpret and then continue to adapt and transform their perspectives, constructs or meanings” (p. 249). It is through the Reflection constructivist lens that executives can learn through personal meaning and social-cultural events to increase the network of constructs to gain knowledge.

Fenwick (2000) continued to describe the second perspective of Interference, the psychoanalytic perspective that speaks to the “realm of unconscious and the resistance to conscious knowledge” (p. 251), which is interesting as the unconscious has the potential to create conflict within complexity. While the Interference perspective pulls tenets from the conscious and unconscious executive’s mind, this aspect does play a large part in how people understand and interpret the quality of those decisions. It is apparent that we make repeated errors in the workplace due to our deep assumptions and potentially unconscious bias of people or events. It is only through understanding the person, his or her

constructs, the social environment, and his or her conscious and unconscious viewpoints that can one produce an accurate and critical reflection viewpoint.

Fenwick (2000) described the third perspective as Participation, a situative perspective, stating that “learning is rooted in the situation in which a person participates” (p. 253), while Resistance, the fourth perspective as it relates to cultural perspectives, is about “power and emphasizes social transformation through experiential learning” (p. 256), which is important for learning systems thinking based on knowledge management theories of sharing tacit knowledge.

Lastly, Co-emergence, the enactivist perspective, is similar to the Participation perspective in that Co-emergence reflection assumes that cognition depends on the situation, environment, and changing systems, and the new information changes behaviors, interactions, and learning. Fenwick laid out the framework for adult education and complexity with the understanding that complexity and, potentially, systems thinking can be learned through cognitive complexities within the adult development and constructivist paradigm.

Donald Schon’s adaptation of the constructivist viewpoint in the workplace may provide further insights. Schon (1983) stated that employees “learn through framing of events, problems and situations of personal interest and their knowledge is constructed through reflection during and after the experimental action” (p. 20). Argyris (1993) focused on a methodology for implementing action theory on a broad scale called ‘*action science*’, which also promotes the role of learning at the organizational level (Schon & Argyris, 1996). The concept of single and double loop learning, in which the learner questions both the system error and the operating norms within the system, was

developed to further understand how the learning cannot be separate from the system and environment in which the learning takes place (Schon & Argyris, 1996).

David Kolb's Experiential Learning Cycle also provides a useful way to describe how one may gravitate towards a specific way of learning, but, more importantly, can provide a process for a continuum of learning through experience. Kolb's (1984) continuous learning process includes four kinds of abilities: concrete experience, reflective observation, abstract conceptualization, and active experimentation.

Additionally, Boud, Keogh, and Walker's (1985) Learning From Experience model moves through the experiences, reflective process, and outcomes while addressing the feelings that the experiences provoke. The premise of this model is that "people need to be exposed and understand the positive or negative emotions generated from the experience to learn better ways to address future events" (Merriam et al., 2007, p. 165).

While Jarvis's model expanded the work of Kolb and critiqued the model as "too simplistic for explaining the complexity phenomena" (Merriam et al., 2007, p. 101), Jarvis developed a model of learning that "begins with a person moving into a social situation, in which a potential learning experience occurs" (Merriam et al., 2007, p. 225). It is through these critical reflection frameworks and episodes that one can reconstruct meaning and beliefs.

To reach a high degree of systems thinking in the workplace, executives could integrate reflection mechanisms into the relevant meetings and problem-solving events that do not merely 'look backward' to past events to pave the way forward with better decisions; rather, they integrate context, alternative seeking processes, and complex understanding of how events, systems, and people self-organize within complexity.

Executives can leverage adult learning theories and cognitive learning processes to provide context of environment, relationships, and connections that build knowledge and construct understanding of actions and behaviors. Knowing that Piaget believed that “learning lies within the individual learner, behaviorist theorists expanded this theory and believe that learning also lies within the environment” (Merriam et al., 2007, p. 254).

The learning from experience theories are not only based on the cognition of the individual, but also within the organization at large, as the theories have evolved to develop organizational learning concepts to address the complexity and fluidity of business dynamics. The concept of informal learning and situated learning comprises key learning theories for unlocking the hidden knowledge within groups, relationships, and networks.

Informal and Situated Learning Theories

Experiences help to frame our rationality, perceptions, and conclusions. Marsick and Watkins’s (1990) theory of informal and incidental learning was based on the Dewey learning framework and stated that context shapes interpretations and action. Informal learning was described as “outside the formally structured, institutionally sponsored, classroom-based activities that often takes place under non-routine circumstances; that is, when the procedures and responses that people normally use fail in leading to greater attention to tacit, hidden, taken-for granted assumptions” (Marsick & Watkins, 1990, p. 21). Further, Livingstone (2001) defined informal learning as “any activity involving the pursuit of understanding, knowledge or skill which occurs without the presence of externally imposed curricular criteria” (p. 4). Table 7 illustrates the types of corporate

learning components adapted from Bersin and Associates's (2009) Enterprise Learning Framework and includes various types of informal learning activities.

Table 7

Bersin and Associates' (2009) Enterprise Learning Framework

Formal	Informal On Demand	Informal: Social	Informal: Embedded
Instructor-led training	E Learning	Wiki, Blogs	Performance Support
Virtual Classroom	Internet Search	Community of Practice	Feedback
Games	Books, Articles, Videos	Forums	Rotational Assignments
Simulations	Podcasts	Expert Directories	Quality Circles
E Learning	Learning/Knowledge Portals	Social Networks	After Action Reviews
Self-directed learning	Learning Libraries	Coaching and Mentoring	Development Planning
Testing and Evaluation	Best Practice Archives	Conferences and Colloquia	Action Learning Teams

Progressive informal and incidental learning research point towards revised and enhanced descriptions that incorporate the key influencers in which people interpret the situation, their choices, the actions and the learning that is affected (Marsick & Watkins, 2001). Marsick and Watkins enhanced their original informal and incidental learning model in collaboration with Cseh. Figure 4 illustrates the belief that learning grows out from everyday encounters while working and living in a given context (Marsick & Watkins, 2001).

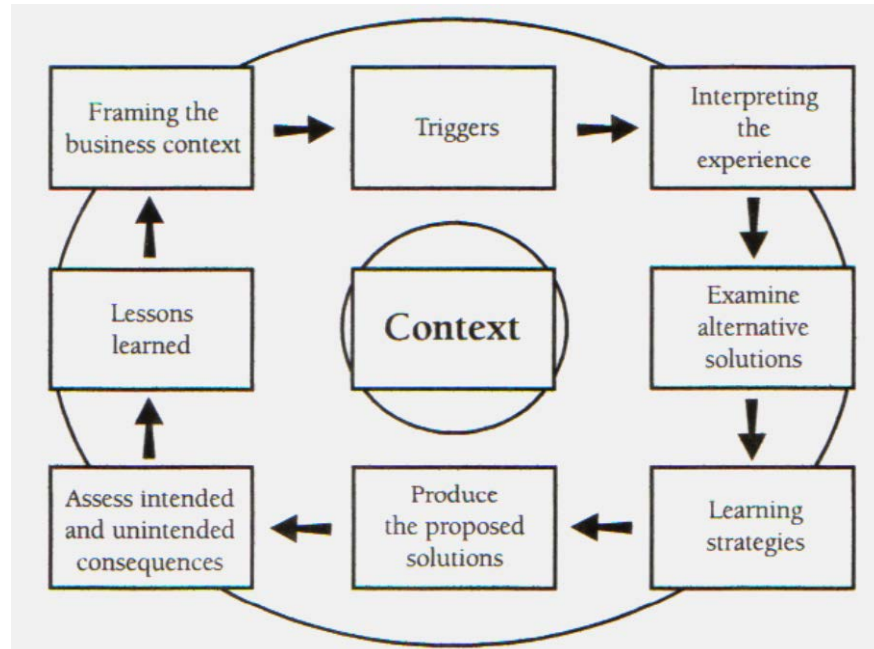


Figure 4. Marsick and Watkins's information and incidental learning model as adapted with Cseh

The image is described as the “outer circle represents the context within which the experience occurs, the personal, social, business and cultural context for learning, while the progression of meaning making is portrayed as the non-linear nor sequential elements” (Marsick & Watkins, 2001, p. 29). This model can serve as a good interpretation of how executives may be learning in ambiguous situations as the learning, or ‘trigger or surprise,’ as described by Marsick and Watkins, is proposed to occur from any of the elements of the model and helps one understand where and when a new frame of learning occurs.

Further research by Marsick, Watkins, Scully-Russ, and Nicolaidis (2016) examined the concepts of complexity and social context in relation to the informal and incidental learning framework and proposed how informal and incidental learning occur through the social, socio-cultural-historical, and complexity model in Table 8.

Table 8

Marsick, Watkins, Scully-Russ, and Nicolaidis's (2016) Models of Informal and Incidental Learning in the Workplace

	Original: Model 1	Social: Model 2	Sociocultural- historical: Model 3	Complexity: Model 4
What is informal and/or incidental learning in the workplace?	A challenge triggers a fresh look at the situation, followed by a search for alternative responses, taking action, and evaluating results; incidental learning is what occurs at the interstices—what emerges when we unintentionally learn something new	An informal learning cycle that occurs through social interaction with others and social sources	A process by which groups engaged in work activities, come to perceive and address development gaps in structures and tools	A process of discerning cause and effect in the obvious and complicated domains—informal learning produces good and best practice results in response to a recognized problem
Perceived relationship between forms of learning (formal, informal, and incidental)	Formal, informal, and incidental are a conceptual continuum of control over the learning process; on intentionality over what is learned	Formal learning is controlled by someone else, while informal and incidental learning are often co-created with and for others	Formal and informal are a dialectical unity—one form of learning is completed in the other	Informal is decoupled from incidental learning to enable a goodness-of-fit perspective of prevailing learning modalities in four domains. Informal fits with obvious and complicated domains; incidental fits with complex and chaotic domains.
Who learns	Individual	Individual in the social context and, through social interaction, others with whom the individual interacts	People complete each other in a broader cycle of ongoing cultural development of people, work practices, and cultural tools	The system learns—the past is integrated with the present as the elements evolve with one another and with the environment

Table 8 (continued)

	Original: Model 1	Social: Model 2	Sociocultural- historical: Model 3	Complexity: Model 4
How learning occurs (processes and practices)	Contextually supported, often self-directed process of problem solving in incidental learning, learning is a by-product of another activity that could be formal or informal learning (the hidden curriculum)	In goal-directed activity individuals and groups access, manipulate, and transform cognitive structures that are socially sourced, resulting in the co-construction and organization of knowledge	Learning processes and practices are situated; learning is contextually constituted, how work and learning are perceived and unfold is sourced by cultural material within the workplace and its broader institutional surround. Incidental learning results in greater awareness of this surround.	Relationships within the system are infused by contextual characteristics, history, and dynamic interactions such that understanding and perception emerge to generate action
Role of social interaction and social relations in learning	Unexplained	Social relations mediate as well as afford or constrain informal learning	Learning emanates from social relations—all learning occurs through inter-subjective processes and interdependent, coordinated action	Complex systems are dynamic, a mesh of interactions and relationships that are constantly evolving, creating ripeness for emergence and a disruption of learned responses
Focus of workplace learning research and interventions	Individual learning processes and practices in the workplace context, as well as frames of mind on the individual level and the constraining and supporting role of the context such as a learning culture	Individual and social learning processes and practices, as well as frames of mind on the individual and group level	The work of adult and workplace educators as well as work itself, including the quality and character of social relations, influence of the institutional context, and development gaps in cultural tools, materials, and practices	The invisible cause-and-effect relationships and patterns of interaction that disrupt learned responses and give rise to a range of action from within learning

Lave and Wenger's (1991) Community of Practice, the Situated Learning Theory, emphasizes that learning and reflective practice within the workplace and social contexts is unintended and situated within authentic activity, context and culture. Lave and Wenger also stated that social interaction is a critical component of situated learning and employees who become involved in the community of practice within their organization learn from the interaction in an informal manner and learning is unintended rather than deliberate. The premise is that the workplace learning is linked with the work and cannot be separated, and the environment and social context are important influencers for learning. Supporting this theory is Kurt Lewin (1946), whose seminal work was based on understanding the links between people and their surroundings and conditions. Lewin (1946) stated that "to understand or to predict behavior, the person and his environment have to be considered as one constellation of interdependent factors" (p. 338).

Eraut (2004) stated the type of informal learning that can take place at work which includes activities such as task performance, awareness and understanding, personal development, teamwork, role performance, academic knowledge and skills, decision making and problem solving and judgement. Eraut further stated that professionals learn through testing and expanding their knowledge when they confront challenges that require adaption or the development of new competencies. Expanding on informal learning outside the classroom and workplace, Hamid-Luker and Uhlenberg (2002) researched non-formal learning in difference contexts, such as in libraries, neighborhood centers, and community groups; this follows Bronfenbrenner's (1994) Ecological Model, which indicated that the proximities overlay for individual learning at the community level. Informal learning adopts reflection as a conscious activity and

integrates the “reflection in action” and “reflection on action” theories (Argyris & Schon, 1978). However, Dewey (1938) stated that reflection must include action and “learners must ask for the meaning of what they learn, in a sense of what difference it makes to the rest of their belief and to their actions” (p. 32). In other words, once an experience occurs, it is up to the learner to make meaning.

Lave and Wenger (1991) situated actions in a world of social communities (community of practice) and described as “a set of relations among persons, activity, and the world, over time and in relation with other tangible and overlapping communities of practice” (p. 98). The situation in which learning takes place is pivotal to the learning from the experience. Miller (1996) stated that even the widely-published research regarding Pavlov’s theory is slightly misguided and “even dogs appreciate situational awareness” (p. 3), in that the dogs did salivate at the sound of the bell, but only if they were in the experimental harness (p. 3). Miller further stated that “being able to contextualize the learning is found through remembering a similar situation in the past and determining meaning to solve the potential ambiguities” (p. 5).

Collated Learning From Experience Concepts

In this context, ‘remembering’ can be defined as reflection on the experience. This premise is supported by Lewin (1946) who distinguished between the physical situation and the psychological “field,” which includes aspects of the real situation that affect our thoughts and behaviors. This contextualization of the environment and how one learns helps one to understand how background, upbringing, education, and experiences may play a strong role in understanding the various degrees of systems thinking capabilities within the workplace. Piaget (1930) acknowledged that social

interaction could play a role in model construction and assist in building socio-cognition awareness (Piaget & Inhelder, 1956). However, Marsick and Watkins (1990) do acknowledge that informal learning is difficult to observe and may not even be recognized by the learner or others. Thus, research has increasingly explored informal learning through context, social and interactions to acquire more understanding of learning from experience theories.

Other theories that incorporate social and situated learning aspects include the Social Learning Theory (Poel, Chivers, Van der Krogt, & Wildermeersch, 2000), Socio-Cultural Theory (Vygotsky, 1978), and Situated Cognition (Lave & Wenger, 1991). Table 9 provides an overview of the learning from experience frameworks that align with the systems thinking commonalities.

Organizational Learning

Organizational learning plays an important role for adult learning theories in the workplace as professional knowledge has an important knowledge sharing element. Eraut (2000) stated “knowledge of context and organizations is often acquired through a process of socialization through observation, induction and increasing participation rather than formal inquiry” (p. 122). Organizational learning expands the learning from an individual perspective and builds the idea of a network of knowledge, while employees are seen as the individual agents empowered to learn from their environment. Holland (2005) stated that complexity increases for learning within complex adaptive systems as “the conditional interactions play such an important role. Even simple mechanisms with

Table 9

Author's Collated Learning From Experience and Systems Thinking Commonalities

Theorist	Key Concepts	Systems Thinking Commonalities	Collated Commonalities
Dewey (1938)	<ul style="list-style-type: none"> • Interactivity • Continuity • Critical Inquiry 	<ul style="list-style-type: none"> • Feedback loops • Interconnections/inter-relationships 	
Fenwick (2000)	<ul style="list-style-type: none"> • Reflection • Interference • Participation • Resistance • Co-Emergence 	<ul style="list-style-type: none"> • Wholes rather than parts • Feedback loops • Dynamic behavior 	
Kolb (1984)	<ul style="list-style-type: none"> • Concrete experiences • Reflective observation • Abstract Conceptualization • Active Experimentation 	<ul style="list-style-type: none"> • Systems structure as the cause of behavior • Interconnections/inter-relationships 	<ol style="list-style-type: none"> 1. Constructivist Perspective 2. Reflection on Experience 3. Inquiry and meaning 4. Social and situational contexts
Boud, Keogh, & Walker (1985)	<ul style="list-style-type: none"> • Reflection on Experience • Affective Understanding • Re-evaluate 	<ul style="list-style-type: none"> • Dynamic behaviors • Feedback loops 	
Marsick, Watkins, Scully-Russ & Nicolaidis (2016)	<ul style="list-style-type: none"> • Informal and incidental learning • Social Context • Reflective Learning • Make meaning from experience 	<ul style="list-style-type: none"> • Dynamic behaviors • Open system • Systems structure as the cause of behavior 	

simple interactions can generate complex behavior” (p. 3). This leads to the notion that a systems thinking mental model and organizational learning are interrelated. In this sense, Gregory and Miller (2001) asserted that “business problems are open to multiple interpretations and their causes, consequences and possible solutions and management education need to offer more than a functionalist analysis of management functions”

(p. 3). Developing this further, organizational learning is often seen as a theoretical perspective that requires concrete processes to be seen as valuable for the workplace.

Theorists Argyris and Schon (1978) were instrumental in the development of the concept of organizational learning through the Theory of Action Perspective. Argyris and Schon were influenced by Lewin's organizational behaviors in the environment and Dewey's Theory of Inquiry. Through this research, Argyris and Schon (1996) referred to organizational learning as the organizations capacity to learn. Through the seminal work of Argyris and Schon, many adult learning theories were developed specifically for the workplace. This includes the: (a) Ladder of Inference model, which is a learning model to help employees understand information and assumptions and create knowledge when encountering differences of perspectives; (b) Theory in Use and Espoused Theory; and (c) the Single and Double Loop learning model (Argyris, 2000). The premise of single loop learning is the process of detecting an error through the operating norms and then proceeding to correct the error, while double loop learning is to question the operating norms. This has also been described in the workplace as 'doing it right versus doing the right thing.' Jaaron and Backhouse (2017) stated that double loop learning involves collecting feedback from the real world that confronts mental models and leads executives to think in terms of world views to grasp unpredictable opportunities for better processes, fresh information and continuous evaluation. Thus, double loop learning encourages system-wide thinking and continuous evaluation (Tsai, Wu, & Chung, 2010).

Peter Senge (1990) developed an organizational learning model that brings in two important elements of workplace learning: mental models and systems thinking. Senge provided a different view of systems thinking from the decision sciences—hard systems

thinking and the cybernetics definition of systems thinking—and developed the conceptual framework for core learning capabilities for teams in three main areas:

(a) *Aspiration*, with personal mastery and shared vision as elements within the concept;
(b) *Reflective Conversation*, with mental models and dialogue as important elements; and
(c) *Understanding Complexity*, with systems thinking as an important element. This continuous process enhances the collective ability to accept, make sense of, and respond to internal and external change. Senge blended Lewin's (1999) action research and group learning methodology into the 'learning organization' (Caldwell, 2011, p. 2).

As mental models and systems thinking form two of the five pillars, Senge (1990) described systems thinking as the “fifth discipline that integrates the disciplines, fusing them into a coherent body of theory and practice” (p. 12). Further, organizational learning research based on Senge's work supports the individual, workplace, and environment learning lens, as Senge defined systems thinking as a “framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots” (p. 68). He developed five disciplines of learning in an organization that includes:

1. mental models: the development of mental models of how individuals see the world and how they act on it;
2. personal mastery: developing patience of viewing reality objectively by individuals;
3. shared vision: a future where individuals are committed to it;
4. team learning: where team members engage in developing a coordinated action; and

5. systems thinking: connecting the previous four components and viewing the organization as a whole.

While Senge (1990) clearly was pivotal in propelling the concept of systems thinking into the organization learning sphere and a new domain of awareness, the intentionality of moving systems thinking from concept to more action learning or experiential learning workplace activities is still seen as a gap in the workplace.

Wenger-Trayner and Wenger-Trayner (2015) discussed the role of ‘system conveners’ and their effect within the organization. The authors described the term *system convener* as someone who “forges new learning partnerships within complex landscapes to build knowledge within the community” (p. 99). Similar to the term *networker*, a system convener’s purpose, overtly or inadvertently, is to “seek new avenues for learning in their drive to build partnerships and knowledge and works primarily to reduce tensions and conflicting business demands” (p. 100), i.e., to create an effective work environment. The system convener’s characteristics are described as being: (a) on a personal mission; (b) passionate and strategic; (c) mavericks on the edge of the organization; and (d) ‘at home, everywhere and nowhere’ (Trayner & Trayner, 2015).

Collated Organizational Theory Concepts

The premise of an organizational learning structure is “organizations learn only through individuals who learn” (Senge, 1990, p. 129). Argyris and Schon (1978) focused on operationalizing the theory to enable good business practices that focused on management of behaviors within the contextual environment. This theory enabled

organizations to learn more about adult learning as a vehicle to execute quality deliverables. Organizational learning can be accomplished by becoming more disciplined in understanding the premise of knowledge, how it is created, and how knowledge can become a form of competitive advantage. This focus helped to revolutionize how workplace learning occurs. Previously, workplace learning was thought of as a ‘training event’; however, the principles of organizational learning are more about how to create ideas, move the ideas across the organization to create new knowledge; and respond to the environment accordingly. Due to the incredibly fast pace of corporate change from technological advancements, workplace learning has become the new *modus operandi*. Table 10 helps to synthesize the organizational theory key concepts, systems thinking commonalities, and any collated commonalities.

Literature Review Summary

Exploring insights into how executives find information, construct knowledge, and apply and share what they know is the new corporate strategic *modus operandi*. Systems thinking is an evolving process based on feedback processes to make informed decisions in rapidly changing and often uncertain contexts. By exploring learning from experience theories that focus on past experiences to resolve a problem or situation, one can reflect on the current experience to assess action to take (Jarvis, 1987; Kolb, 1984). “If we only knew what we know” (O’Dell & Grayson, 1998, p. 154) speaks to the need to leverage insights, experiences, and behaviors with feedback loops, reflective practice, and systemic perspective taking to gain knowledge in order to achieve decision quality.

Table 10

Author's (2019) Collated Organizational Learning and Systems Thinking Commonalities

Theorist	Key Concepts	Systems Thinking Commonalities	Collated Commonalities
Senge (1990, 2010, 2011)	<ul style="list-style-type: none"> • Personal Mastery • Systems thinking • Mental models • Shared vision • Team learning 	<ul style="list-style-type: none"> • Wholes rather than parts • Open systems • Dynamic behavior • Interconnections/inter-relationships 	
Lewin (1936)	<ul style="list-style-type: none"> • Behavior is a function of the Person and the Environment 	<ul style="list-style-type: none"> • Dynamic behavior • Open system • Systems structure as the cause of behavior 	<ol style="list-style-type: none"> 1. Dynamic mental models 2. Reflection on Experience 3. Behavior and situation awareness
Argyris & Schon (1978)	<ul style="list-style-type: none"> • Reflection in/on Action • Double loop learning • Ladder of Inference • Interaction & Experiences 	<ul style="list-style-type: none"> • Wholes rather than parts • Open system • Non-linear relationships • Feedback loops 	<ol style="list-style-type: none"> 4. Double loop learning 5. Open dialogue
Lave & Wenger (1991)	<ul style="list-style-type: none"> • Personal mission • Passionate and strategic • Mavericks on the edge • At home, everyone and nowhere 	<ul style="list-style-type: none"> • Interconnections/inter-relationships • Non-linear relationships 	

The literature review offered the reader a journey to understanding the key elements the researcher proposed as potential components for understanding more about how to develop a systems thinking mental model. This research described the systems thinking mental model that integrates a learning lens with elements from mental models, complex adaptive systems, and learning on experience theories as the intellectual cognitive and behavior capacity to reflect on, examine and adapt perspectives, assumptions and beliefs to seek meaning from dynamic connections, interactions and

behaviors to determine the ideal decision pathway. The conceptual framework which follows provides a visual image of a systems thinking mental model.

Conceptual Framework Description

The conceptual framework is a guided model that explains the main elements studied, such as key factors, constructs, or variables, and the relationships between them (Miles & Huberman, 1994, p. 18). The conceptual framework also provides a visual representation of the systems thinking, mental models, and learning from experience theories. As systems thinking has emerged and diverged through the decision sciences, systems theories, and adult learning theories, the conceptual framework incorporates the main characteristics as a systems thinking mental model, and must incorporate a “systems as a whole” and integrate the individual, organization, and environment into the coding schemes. The researcher moved through a series of coding steps to identify the key concepts from each theory and align the key components from the literature review. This is illustrated in Table 11, which collates the information from Tables 3, 6, 9, and 10. Table 11 provides the synthesis of the systems thinking mental model conceptual framework, while Figure 6 provides the systems thinking mental model conceptual framework image.

The conceptual framework image in Figure 5 is modelled first with the Bronfenbrenner Ecology Model in mind, an open system, to replicate the complexity within the environment that includes the influencers, elements, and experiences that may integrate more understanding about how systems thinking mental models are learned. Second, the conceptual framework image also illustrates a format to show the

multilayered and interconnected networks. Third, the nested linkages co-exist with the emerging insights from the researcher's literature review that align with various systems thinking, mental models, and adult learning theories that seek to showcase the fluid and dynamic structure of non-linear relationships, connectivity, and the various layers. Fourth, the literature from the relevant systems thinking, mental model, learning from experience, and organizational learning theories is included within the collated key concept charts.

Table 11

Author's (2019) Systems Thinking Mental Model Conceptual Overview

Systems Thinking	Mental Models	Learning From Experience	Organizational Learning
<ul style="list-style-type: none"> • Wholes rather than parts • Feedback loops • Open systems • Dynamic behavior • Systems structure as the cause of behavior • Non-linear relationships • Interconnections/interrelationships 	<ul style="list-style-type: none"> • Beliefs • Sense making • Reflection • Assumptions • Social constructs • World views 	<ul style="list-style-type: none"> • Social constructivist perspective • Reflection in/on experience • Make meaning on experiences • Social and situational context 	<ul style="list-style-type: none"> • Dynamic mental models • Reflection on experience • Inquiry • Behavior, social and situation awareness • Open dialogue
Conceptual Framework (Collated Concepts)			
Individual	Organization	Environment	
<ul style="list-style-type: none"> • Social constructivist perspective • Making meaning from experience • Dynamic mental models • Reflective practice 	<ul style="list-style-type: none"> • Dialogue and knowledge seeking • Self-organization • Fluid agents • Feedback loops 	<ul style="list-style-type: none"> • Complex adaptive system • Social, behavior, and situation awareness • Open system • Interconnected systems and relationships 	

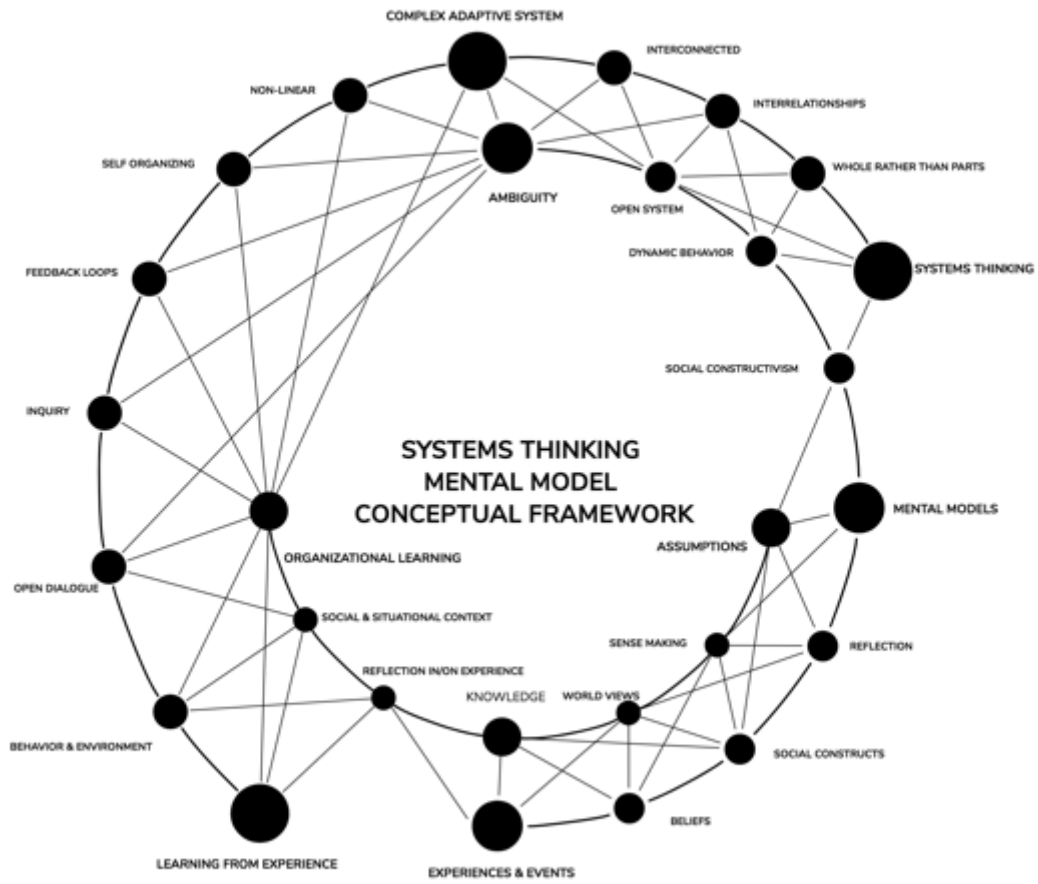


Figure 5. Author's systems thinking mental model conceptual framework

Chapter III

METHODOLOGY

This exploratory study sought to expand what is known about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of 12 global executives working in the United Arab Emirates (UAE) within complex adaptive systems (CAS) and their understanding of their thinking patterns or mental models that may have assisted in learning how to develop a systems thinking mental model to manage business ambiguity. The research questions were developed to identify the types of experiences, perceptions, thinking patterns, and enablers—whether within the individual, organizational, or environmental context—that may have provided the executives’ strategic learning path. The significance of the research may provide more understanding of and insights into how others can learn to enhance their own systems thinking capacity to manage better business outcomes.

The research methodology for this study used three main data collection areas: semi-structured interviews, a focus group session, and a demographic questionnaire which sought to operationalize the exploratory study design by providing an overview of the research approach and the rationale for the social constructivist paradigm approach. The research design outlines the research methodology, methods for sampling, data collection, and data analysis as well as the research exploratory design. The research

design also provides the framework for the research problem, understanding the type of data required, the methods that were used to collect and analyze the data, and how the data and analysis provided insights into the research problem. Finally, the methodology includes Areas of Information Needed, Research Phases, Data Collection, Study Sample, Methods for Data Collection and Data Analysis, Validity and Reliability, Limitations, and Timelines.

Qualitative Methodology

This qualitative research study used the social constructivist lens to focus on understanding the processes by which the phenomena are constructed and understood within the constructs and highlights the need for the researcher and participant to interact to co-construct meaning (Creswell, 2003; Denzin & Lincoln, 2000). The study used a qualitative approach in order to “explore the meaning of the participants’ experience” (Maxwell, 2005, p. 22), to understand the influence of the context in which the research was situated, and to generate new insights into how a systems thinking mental model is learned. Systems thinking theorist Forrester (1993) identified qualitative data as the main source of information in a systems thinking modeling process, while Sterman (2000) used qualitative data from structured interactions with clients. Thus, the center of this study explored the participants’ “meaning and understanding through their narratives, how they make sense of the world and their experiences” (Merriam, 1998, p. 6) and “understand the context of their thinking and behaviors” (Maxwell, 2005, p. 75). This approach allowed the researcher to understand the events, experiences, situations, and, ultimately, context of the participants’ understanding of their own systems thinking mental model.

Exploratory Research Design

The qualitative study was deemed “exploratory,” as Wright (1995) stated an exploratory research focus will place emphasis on understanding from the participant’s point of view and have an explorative orientation and holistic perspective. The aim of exploratory research is to seek the boundaries of the environment in which the problems, opportunities, and situations of interest are likely to reside and to identify the salient factors or variables that might be found relevant to the research (Webb, 1992). Webb further stated that exploratory research seeks to discover something of interest. The exploratory research design was suitable for this research study as there is a high level of uncertainty regarding systems thinking and there is limited research on adult learning frameworks regarding a systems thinking mental model.

The researcher conducted the study as an iterative process that included the following phases: plan, design, prepare, data collection, data analysis, and data sharing (Yin, 2014, p. 2). Figure 6 illustrates the iterative process that began between the preparation and data collection phases and continued through the data collection and analysis phases. During the process, the researcher needed to revert to the design phase and readjust the interview context. Additionally, the researcher was required to reflect on the data between the preparation, data collection, and data analysis phases to address multiple perspectives and avoid assumptions.

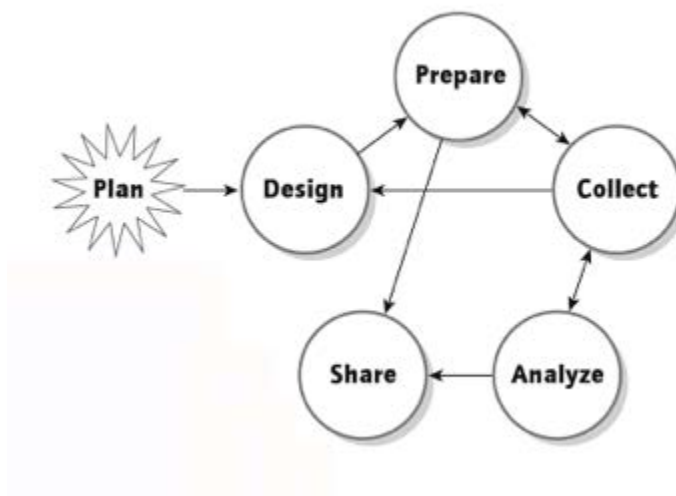


Figure 6. Yin's (2014) research process

Based on this framework, the researcher adopted the ‘researcher as instrument’ protocols into the interview protocols to create an open dialogue with the participants to provide their narratives such as thoughts, feelings, beliefs, and assumptions of how the executives learned to develop their systems thinking mental model (Marshall & Rossman, 2010). Chapter III also includes the research method, areas of information required, participants’ criteria for selection of the interview and focus groups, and methods for addressing confidentiality, data collection, and data analysis. The concepts of validity and reliability, limitation, and timelines are also included.

Richards (2005) noted that a “qualitative study cannot begin without a plan” (p. 14). The research design or ‘plan’ began with a research problem and the development of good research questions that are tentative and exploratory, but gave the researcher the opportunity to define the primary focus of the study (Creswell, 2007). Denzin and Lincoln (2000) stated, “the choice of research practices depends upon the questions that

are asked and require the researcher to elicit and explore the meaning of the participants' narratives and description of events from their perspective through the qualitative research design" (p. 3). Questions such as "What is going on here?" (Charmaz, 2006, p. 57) and "What do I want to know in this study" (Janesick, 2000, p. 433) may address different research designs such as exploratory, explanatory, descriptive, or emancipatory (Marshall & Rossman, 2006). This study aimed to explore the following main research questions and subquestions:

Research Question 1: What characterizes the mental models the executives hold?
(the distinct nature or features of their beliefs, behaviors, and principles)

- A. How do the executives' beliefs of ambiguity influence the development of a systems thinking mental model?
- B. What thinking strategies do the executives employ to make sense of ambiguous or uncertain situations?

Research Question 2: What are the experiences that provide the scaffolding in developing a systems thinking mental model? (experiences and events)

- A. What role does the executives' experiences and education play in the development of a systems thinking mental model?
- B. What type of events or situation impacts the executives' learning of a systems thinking mental model?

Research Question #3: What aspects of the individual, organizational, and environmental interactions enable executives to learn how to develop a systems thinking capacity? (relationships, systems, and elements)

- A. How do the executives develop their knowledge and decision-making architecture within ambiguous situations?
- B. What elements, influencers, and interactions promote better business outcomes?

This research design encouraged the process of (cognitive) thinking and reflection (Mason, 2002, p. 25) and provided an appropriate mode of inquiry for the research questions (Denzin & Lincoln, 2000, p. 22).

Social Constructivism

Since Aristotle's claim in *Metaphysics* that knowledge is derived from the understanding of the whole and not that of the single parts (Ross, 1924), the research design aligned with the premise that knowledge is created from understanding the network, relationships and patterns, and developing a 'sense making' of cause and effect of variables is important (Weick, 1995). Piaget's (1977) research led to the theory of knowledge as being constructive by the actions or thinking upon objectives. Piaget described himself as a constructivist and explained that objectives are nothing until we do something with them. Therefore, seeking to understand knowledge and interpret the knowledge is important to understanding how a systems thinking mental model is developed, given that the basic beliefs of the constructivism paradigm states no one explanation is ever possible, only windows of theories and "reality exists only in the context of a mental framework (construct) for thinking about it (Guba, 1990, p. 25).

Constructivism is an approach to understand thinking processes based on the notion that "discourse about the world is not a reflection of the world but is a social artifact" (Candy, 1991, p. 293). Similar to the post-positivism and critical theory

epistemologies for acknowledging the human and values aspect of research inquiry, the “constructivism epistemology thus tends neither to predict and control the ‘real’ world, nor to transform it but to reconstruct the ‘world’ at the only point at which it exists: in the minds of the constructors” (Guba, 1990, p. 27). The constructivism paradigm ontology states that there are multiple realities with multiple constructs and these change the focus of inquiry research from “what is out there” to “what creates them” (p. 20).

Social constructivists believe that knowledge is constructed when individuals engage on the social level with external factors that includes cultural and social interactions as factors for learning (Vygotsky, 1978). Candy (1991) stated that becoming knowledgeable involves acquiring the symbolic meaning structures appropriate to one’s society” (p. 275). Supporting this paradigm thinking is Carol Gilligan (2012), who stated relationships are like being on a trampoline; if one element changes, it resonates throughout. Gilligan viewed the world as a web of relationships and strongly advocated (from the women’s viewpoint) for learning development within the interconnected relationships (Merriam et al., 2007, p. 376).

Therefore, the research design rationale was to understand the participants’ background and previous personal and professional experiences to understand the influencers, relationships, and elements that helped to interpret meaning of the development of their systems thinking mental model from a constructivist approach in order to identify the patterns of thought, experiences, and narratives and, ultimately, the “meanings are constructed by human beings as they engage with the world they are interpreting” (Creswell, 2007, p. 8).

Areas of Information Needed

The information needed to satisfy the research questions came from three data collection areas: the semi-structured interviews for the 12 selected executives, the focus group session with six different selected participants, and the demographic questionnaire. However, the primary form of data came from the semi-structured participant interviews. Interview research is considered the mainstay of social science qualitative data collection and the researcher was required to remain unbiased by the behavior and/or narrative of the participant and query for specific information that allowed for enhanced descriptions. Interview protocols were established and served as a guide (Rubin & Rubin, 2005). Triangulation was achieved through additional data collection sources: the focus group session and the demographic questionnaire, as described in further detail later in this chapter. Table 12 provides a framework of the information collected for this study by data source that includes demographic (background), conceptual, and perceptual information. The purpose of ensuring the data came from various categories provided a wide-angle lens for ensuring the data were holistic and aligned with a systems thinking foundation.

Table 12

Data Collection Source

Research Questions	Semi-Structured Interview	Focus Group Session	Demographic Questionnaire
Demographics			X
Perceptual	X	X	
Conceptual	X	X	

Demographic Information

The demographic questionnaire collected the following information: gender, age bracket, education level (degree type), language, position title, years of experience working in CAS or ambiguous environments, nationality, and number of countries in which the participants had worked. The purpose of this type of data collection was to “acquire knowledge of the participants’ history and context,” as Senge (1990) noted the “assumptions we hold are acquired from a pool of culturally acceptable assumptions” (p. 225). The demographic information provided an explicit pattern(s) of collective thought based on origin, language, or educational level for the participants’ systems thinking mental model.

Perceptual and Conceptual Information

The core research questions guided the perceptual and conceptual information for the study. The research questions within the semi-structured interviews aimed to elicit the executives’ descriptions and narratives of the belief, behaviors, and principles surrounding ambiguity in the workplace as they pertain to the background, perceptual, and contextual information areas. The perceptual information collected helped to understand the participants’ awareness of their surroundings through the senses and how they perceive their reality and worldviews; the conceptual information was gleaned through the participants’ understandings of their abstract ideas and thinking patterns that have a bearing on their knowledge and previous learning.

The first research question was developed to uncover the executives’ thinking styles that enabled them to make sense of their reality when faced with ambiguity. The second research question probed into their experiences and if there were any specific

events that helped develop their understanding or learning of systems thinking. The third research question uncovered their point of view of their environment, relationships, and the systems around them to verify if there were any significant learning elements and influencers. The researcher was required to be cognizant of not only the participants' descriptions of events, but also their behavior and narratives which provided a 'frame of reference' to code the data. The qualitative and social constructivist approach helped to discover their systems thinking mental model formulation (see Table 13).

Table 14 outlines the interview questions that enabled the relevant information to be discussed to answer the research questions. The interview questions were guidelines and probing was used to seek specific indicators that captured the rich context for attempting to answer the research questions.

Overview of Research Design

The research design consisted of five main areas that aligned with Maxwell's (2013) Interactive Model of Research Design (p. 5). The interactive model included the research goals, conceptual framework, research questions, validity, and method that enabled the researcher to follow a structured research study design. At the same time, it provided flexibility through the interactive model to deal with influencers and elements that informed the research (and researcher) to assess, modify, or expand the research components based on the systems feedback or new insights. As described by Maxwell (2013), the Model of Research Design top area is the conceptual portion of the study and is a closely integrated unit while the bottom area is the more operational portion of the

Table 13

Demographic, Perceptual, and Conceptual Information

Research Questions	Information Needed	Area
RQ1: What characterizes the mental models the executives hold? (the distinct nature or features of their beliefs, behaviors, and principles)	A. How do the executives' beliefs of ambiguity influence the development of a systems thinking mental model? (ambiguity, complexity)	Perceptual
	B. What thinking strategies do the executives employ to make sense of ambiguous or complex situations? (Sense making, behavior understanding)	Conceptual
	C. What are the affective elements that are prevalent? (behavior, emotions, stress, trust)	Perceptual
RQ2: What are the experiences that provide the scaffolding in developing a systems thinking mental model? (experiences and events)	A. What role does the executives' experiences and education play in development of a systems thinking mental model? (Conflict, training, mentoring, projects, education type and level)	Perceptual
	B. What type of events or situation impacts the executives' learning of a systems thinking mental model? (Upbringing, significant moments)?	Perceptual
RQ3: What aspects of the individual, organizational and environmental interactions enable individuals to learn how to develop systems thinking capacity? (relationships, systems, and elements)	A. How do the executives develop their knowledge and decision-making architecture within ambiguous situations?	Conceptual
	B. What elements, influencers and interactions promote better business outcomes? (communication, relationships, feedback, reflection)	Perceptual

Table 14

Interview Questions

Research Questions	Information Needed	Interview Questions
RQ1: What characterizes the mental models the executives hold? (the distinct nature or features of their beliefs, behaviors, and principles)	<p>A. How do the executives' beliefs of ambiguity influence the development of a executive's systems thinking mental model?</p> <p>B. Which thinking strategies do the executives employ to make sense of ambiguous or complex situations?</p>	<p>1.1. Tell me a little bit about your background and upbringing.</p> <p>1.2. It is becoming more difficult to predict business outcomes as the rapid pace of change, interconnectedness, and the layers of dependencies increases, patterns and cycles of events, plethora of information, and fluidity of relationships. Tell me how you try to understand the ambiguity within the workplace.</p> <p>1.3. What is your perception/beliefs of the unexpected changes/errors that occur in your workplace due to these challenges?</p> <p>1.4. When ambiguity creates challenges, describe your thinking and behavior during these situations. And what type of feelings occur?</p>
RQ2: What are the experiences that provide the scaffolding in developing a systems thinking mental model (experiences and events)	<p>A. What role does the executives' experiences and education play in development of a systems thinking mental model?</p> <p>B. What type of events or situation impacts the executives' learning of a systems thinking mental model?</p>	<p>2.1. When faced with a puzzling pattern of events, what experiences or significant learning moments, helped you to understand or anticipate the next step? What did you pay attention to?</p> <p>2.2. Described the scenario(s) that helped you learn or shape your thinking style? (good or bad scenarios)</p>
RQ3: What aspects of the individual, organizational and environmental interactions enable individuals to learn how to develop systems thinking capacity? (relationships, systems, and elements)	<p>A. How do the executives develop their knowledge and decision-making architecture within ambiguous situations?</p> <p>B. What elements, influencers, and interactions promote better business outcomes?</p>	<p>3.1. Describe to me when or where the 'good' learning moments occur. What elements, environments, people or influencers are present?</p> <p>3.2. Describe if your 'ambiguity thinking' style has changed over time. What has influenced the changes?</p> <p>3.3 If you were to guide future leaders on developing a systems thinking mental models, what would be the one or two key learning lessons?</p>

study and the Methods category should provide the answers to the research questions (see Figure 7).

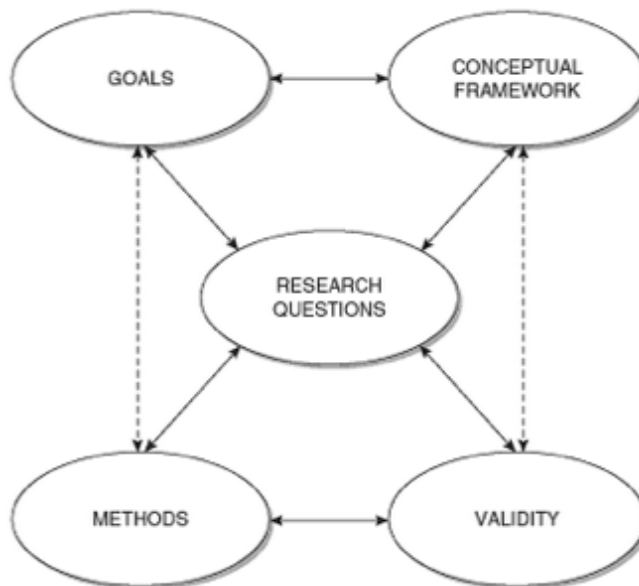


Figure 7. Maxwell's (2013) interactive model of research design

The 'operational' portion of the research was conducted in three main areas within the Methods category, via the demographic questionnaire, semi-structured interviews, and the focus group session.

Selection of Participants

The researcher identified the ideal interview participants who formed the main data collection source by searching her personal and professional network in which she was aware of the executives' professional achievements within various CAS or ambiguous workplace environments. The executives were approached in both an informal and a formal manner to seek their participation. For example, as many of the executives are considered "elites," access to the executives were hard to secure in a formal manner. As described in Chapter I, elites are stated as individuals with "power and

influence and are considered influential, prominent, and/or well informed in an organization or community and are selected for their in-depth perspectives” (p. 159). The protocols for participant selection were the executives must have worked in the UAE and have more than 10 years of experiences working within at least two complex adaptive systems. The complex adaptive systems selection criteria, as described in Chapter II include domains that may have the presence of multiple stakeholders or multiple business models; connections to joint ventures and partnerships; or major or frequent external interrelated influencers from the business, government, or academic domains. The selected participants must also have worked within the highest executive level or operated within one reporting line for the highest level and may have had titles such as CEO, CFO, or President.

Thus, the researcher relied on professional and personal connections to the executives to seek a preliminary acceptance that was completed through a personal call, email, or message system. The researcher then forwarded the formal research study protocol invitation to participate once the executive agreed, in premise, to participate. The researcher preselected 12 executives, and once the informal acceptances were received, she sent all 12 formal research study invitations. The researcher expected that due to the executives’ busy schedule, a 90-minute time slot may be difficult to secure, and the researcher anticipated scheduling the executives to be a time-consuming task.

The overall preparation included setting up the following: participants’ scheduling and tracking sheet that included the date of invitation sent, acceptance, scheduled date, and assigned numeric code name for each participant. The researcher purchased the Dedoose software access, identified the ideal transcription service with Non-Disclosure

Agreements, and selected two types of recording devices for the interviews. Next, password-protected computer files were created with the executives' names and assigned numeric code names. All documents were printed and prepared in advance and readied as the researcher noted the executives may have ad hoc scheduling and anticipated multiple changes in scheduling. All recruitment methods included the IRB Protocol number which was included in the Informed Consent Forms, email invitation, and other participant-provided documents.

Pilot Studies Lessons Learned

To ensure a professional approach was used for the interviews, the researcher conducted two pilot interview sessions to practice interviewing protocols and seek insights and learning into the process. The first pilot study was conducted with two executives who work in CAS or ambiguous situations and the interview questions were prepared in advance to focus mainly on their understanding of systems thinking. While the interviews were conducted with success—meaning there were no issues with the scheduling, interviewing, recording, or analysis, the researcher noticed the two participants had widely different views of knowledge architecture, complexity, and systems thinking. Moreover, most of their responses were from a tactical or operational perspective. As such, the researcher reviewed the interview questions to verify if the interview questions were aligned with seeking answers to the actual research questions. The researcher also reviewed the research design goals and conducted a review of the conceptual framework to verify how to develop interview questions that dove more deeply into the participants' cognitive insights and their 'thinking about thinking' perspectives.

Thus, prior to the second pilot study, the researcher revised the interview questions to seek more insights into the two new participants' 'understanding' of systems thinking and glean more perceptual and conceptual information. The researcher experienced the same procedural success in conducting a semi-structured interview, and the pilot study interviews provided insight into and understanding of the participants' systems thinking mental model to a greater depth. To collect more insights, the researcher proceeded to code the transcribed interviews and found the participants used fewer technical/domain specific insights (as per the first pilot study participants) and provided more behavioral and cognitive insights into understanding their systems thinking mental model.

The researcher further refined the goals of the study to expand the notion of systems thinking through understanding of the executives' thinking patterns and the learning lens used to seek clarity of their own cognitive complexities. The 'exploratory' research design enabled further refinement of the interview questions to "uncover or explore the participants' meaning and understanding through their narratives" (Merriam, 1998, p. 6) and placed emphasis on understanding from the participants' point of view with an explorative orientation and holistic perspective (Webb, 1992).

Semi-Structured Interviews

The interviews were ideally scheduled to be in the late afternoon when the executives were still in the workplace, with fewer office and personnel interruptions. The researcher attempted to meet with each executive in his or her office to understand more about the context of the environment. To prepare for the interviews, the researcher forwarded the Informed Consent Form, the interview questions, and concept definitions

at least 1 week prior to the interview and brought at least two methods for recording the interview and materials to capture the executives' images (if they wished to illustrate their thinking) and follow-up note taking.

Inter-Reliability Testing

The researcher did not want to schedule all the interviews in the same month as the purpose of scheduling the interviews with a time span between them was for the researcher to pause periodically and review the transcripts to verify if the interview results and preliminary coding were aligned with the conceptual framework. Hence, the iterative research design allowed the researcher to reflect on potential researcher bias or assumptions that may have influenced the data collection or coding (Maxwell, 2013). In order to preempt this possibility, the researcher approached two doctoral students to assist with coding insights and complete peer-coding inter-reliability testing. The two doctoral students conducted coding of two interview transcripts with the researcher's preliminary conceptual framework coding scheme to verify if the peer coding provided additional insights that required an adjustment of the conceptual framework, research interview style, or coding scheme. Based on the peer discussion and new insights, the researcher moved toward the second coding scheme, inductive coding, to seek a broader view of how to look at the data. This enabled the researcher to create three subquestions in the interview protocols as an attempt to uncover more cognitive insights from the participants.

Interview Analysis

Once the interviews were completed, the researcher ensured the Demographic Questionnaire was completed and thanked the participants for their time and insights both face-to-face and through an email the next day. The email provided an opportunity for the participants to ask questions, if needed. In order to capture the environmental and situational nuances that occurred during the meeting, the researcher set aside 30 minutes after each interview and provided additional details that not only allowed for improvements for the next interview, but also collected data on the participants' mood, engagement levels, and potential environmental factors. The researcher notes were collated to define any patterns.

Seventy-five percent of the interviews were conducted face-to-face and 25% were completed via Skype due to the executives' busy travel schedules. Two of the interviews were conducted in coffee shops adjacent to the office and two in hotel restaurants; the remaining interviews were completed in the executives' boardrooms. While each interview took over 3 weeks to schedule due to multiple scheduling changes, each executive, during the actual interview, was gracious with his or her time and did not display any outward signs of rushing through the interview. However, one executive who was interviewed in the company coffee shop did seem somewhat rushed. It was later noted that the executive was scheduled for multiple meetings, one before and after the interview in the same coffee area; thus, due to the busyness of the coffee shop, this created a feeling of being rushed for both the executive and the researcher to complete the interview. The researcher requested 60 minutes to be blocked for the interview. Each interview ended up being close to 60 minutes in length, with the one interview in the

company coffee shop completed in 45 minutes. The interview process was scheduled to complete at least two and up to four interviews per month; however, due to the executives' busy schedules, an originally scheduled 4-month interview process ended up taking almost eight months.

The researcher noted that while systems thinking and mental models are complex subjects to discuss, only one executive asked any clarifying questions regarding 'systems thinking' per se. The researcher noted that each executive was comfortable with the provided definitions and research overview and was ready to conduct the interview. One executive had prepared notes for the interview, while the other executives each mentioned they contemplated the subject prior to the interview for which examples of their background or experience might be relevant to discuss. Even so, each interview was conducted in a casual tone, with almost 50% of the 60-minute interview time period spent discussing the mental models' portion of the interview questions and the remaining part spent discussing the events, influences, and experiences that might be evident in a systems thinking mental model.

Figure 8 outlines the participants' demographic information while Chapter IV provides the reader with contextual information about the executives' work domains as it applies to complex adaptive systems within the UAE.



Figure 8. Interview participants' demographics

Focus Group Session

Focus groups are well suited for exploratory studies in undefined domains, such as systems thinking, as the “lively collective interaction may bring forth more spontaneous expressive and emotional views than in individual interview” (Brinkmann & Kvale, 2013, p. 176). The nondirective style of interviewing typically consists of “six to ten participants led by the moderator and the prime concern is to encourage a variety of viewpoints on the topic” (Chrzanowska, 2002, p. 21). The purpose of the focus group session is to provide the researcher with insights into a systems thinking mental model through an alternative qualitative method, with different selected participants to triangulate the data and coding scheme.

The method to secure the participants for the focus group was similar to securing the interview participants as the focus group participants were approached and scheduled in the same manner. The difference was that the actual focus group session was an individual cause-effect systems thinking mind map activity and discussion to elicit more information about the topic. The 60-minute session was conducted in a conference room of the researcher’s choosing and participants were provided with different schedule options to ensure they could attend the session.

The data were collected in three main forms, through the concept maps the six participants created, demographics questionnaire, and discussion of five questions that were similar to the interview questions which included: (a) How do you try to understand ambiguity within the workplace (or within the posed scenario)? What are your learning ‘ambiguity’ actions? (b) What are your perceptions/beliefs of the unexpected changes/

errors that occurred (cause-effect situations)? (c) When you are faced with puzzling patterns of events, what experiences or significant learning moments helped you to understand or anticipate the next step? What are you paying attention to? (d) When you have a good ‘ambiguity’/complex learning moment, what elements, people, or influencers are present? What is going on? and (e) If you were to guide future leaders through ambiguous situations, what thinking strategies would you use (key learning lessons)?

The focus group conducted the exercise and then each participant presented his or her scenario, highlighting the identified: (a) cause-effect areas, (b) links and interactions, and (c) positive and negative feedback loops. They then presented their answers to the questions. Finally, the small group had a brief discussion on the themes that were discussed from the scenario and the responses to the five questions. The researcher audio-recorded the discussion portion of the focus group.

The participants’ pictorial illustrations and summary sheets were collected after the session and images were coded according to the participants’ coded name. These were analyzed for interpretations of systems thinking scenarios and identified elements that highlighted the participants’ systems thinking mental models. The six participants were from diverse domains, ages, demographics, nationalities, and education levels and academic achievements (see Figure 9).

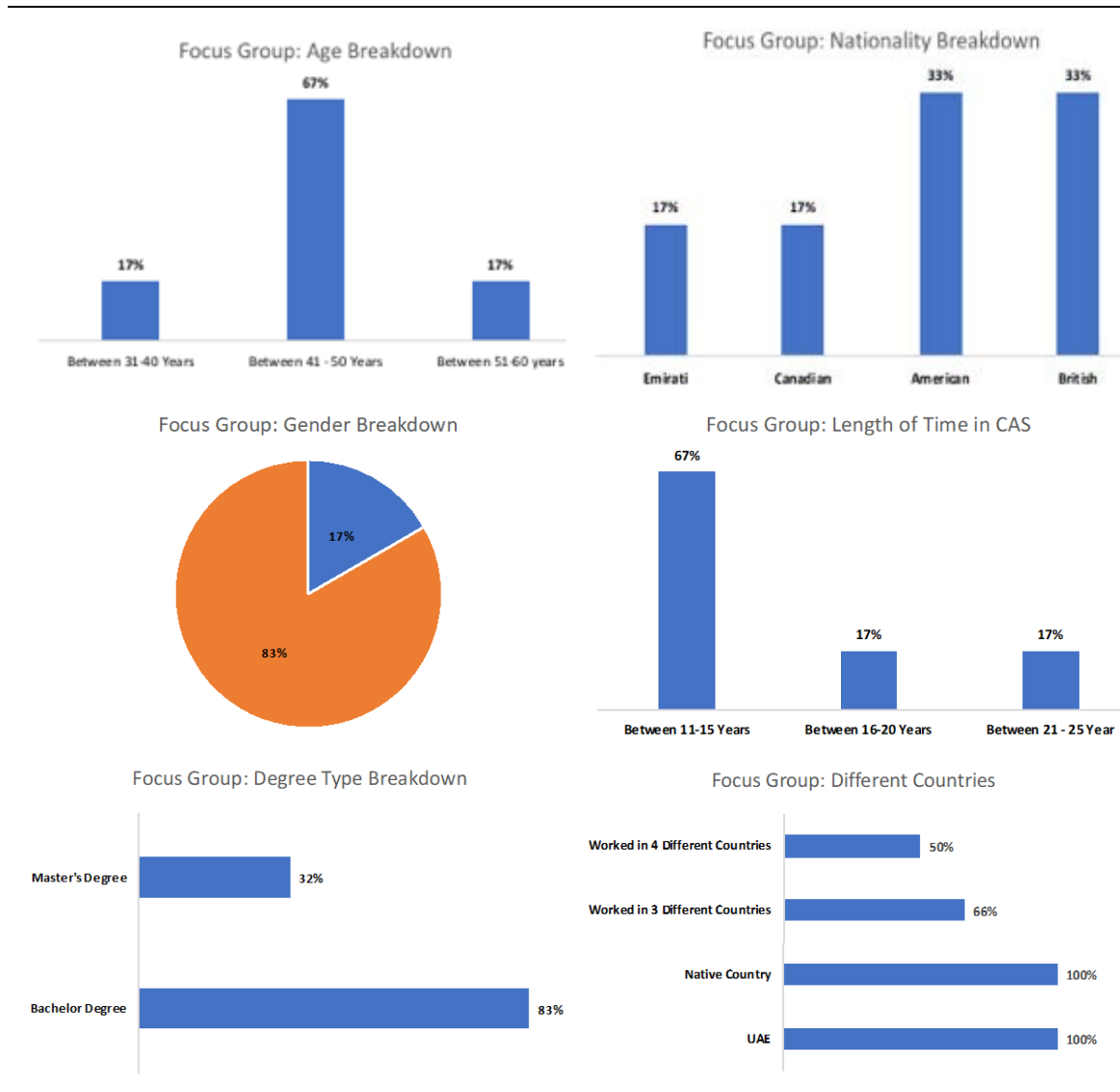


Figure 9. Focus group participants' demographics

Coding and Analysis

As the participants' perceptions directed their actions, thoughts, and feelings, it was necessary to analyze the content and narrate the meanings they attached to particular processes, situations, and events (McMillan & Schumacher, 2001, p. 396). The researcher planned how the analysis, interpretation, and synthesis procedures would develop over the course of the study. The researcher prepared the following plan that included:

(a) interview transcription; (b) setting up the Dedoose qualitative software program and becoming familiar with the functions for loading, coding, revising, peer sharing, coding functions, and analysis; (c) the coding process; and (d) interpretation and synthesis. The researcher conducted a literature-driven framework to create the conceptual framework in which she synthesized the coding scheme through an analysis of systems thinking main concepts as aligned with collated mental model, learning from experience, and organizational theory concepts to arrive at the macro conceptual framework categories.

A code is a “qualitative inquiry that symbolically assigns a summative, salient and essence—capturing for the data” (Saldana, 2009, p. 16). Saldana described first cycle coding as “a process that can range in magnitude from a single work to a full sentence to and entire page, while second cycle coding includes portions of the coding of the same units, longer passages of text and a reconfiguration of the code” (p. 16). Charmaz (2001) described coding as the “critical link between the data collection and their explanation of meaning” (p. 57).

This method of coding is not ‘labeling,’ but ‘linking,’ and “it leads one from the data to the idea and from the idea to all the data pertaining to that idea” (Richards & Morse, 2007, p. 137). Thus, the first cycle coding aligned with the conceptual framework

code, which was created by the linking of literature review collated similarities, a deductive coding exercise to verify the presence of systems thinking references within the transcription. However, deductive coding was not the ideal method to capture the intent to explore a systems thinking mental model. Thus, an inductive method, similar to Saldana's (2009) coding methods, was explored as "coding is not a precise science; it is primarily an interpretive act" (p. 193). In fact, multiple coding approaches are encouraged to enhance accountability and depth and breadth of findings (Coffey & Atkinson, 1996; Leech & Onwuegbuzie, 2005; Mello, 2002).

The coding process involved the In Vivo Coding process which "draws from the participants' own language for code" (Saldana, 2009, p. 84). For example, a participant used the term *information addict*, while other participants used words such as 'information seeker' or 'open to new information.' Thus, 'information addict' was used as a code in the second level of coding to illustrate the *need* for information rather than an *information gathering exercise* to explore the meaning of the intent. Through the second level 'in vivo' coding exercise, the 15 original deductive codes exploded into over 74 different codes with multiple transcript references for each code that highlighted "literal or verbatim coding for actual language found in the qualitative data record" (Strauss, 1987, p. 33). The third coding process included an additional review of the data and codes to collapse the 74 different codes into "overarching categories or themes to create a large data set" (Namey, Guest, Thairu, & Johnson, 2008, p. 141).

The interpretative and synthesis process included the data from the demographic questionnaire, the focus group, and the interview sessions in relationship to the context of the participants' values, opinions, insights, and social learning contexts. Specific

protocols were used to provide structure and build confidence in the process of collecting the data, analyzing the findings, and formulating the coded results. To ensure continual integrity of the research process, the researcher conducted periodic meetings with her advisor to discuss progress and address any questions or issues that may have transpired. The research and analysis are an iterative process; however, the main research steps are somewhat systematic and are described in Appendix K.

Research Sample

For this study, the researcher approached current and former colleagues at the senior executive level who currently work within complex and ambiguous environments within the United Arab Emirates. The researcher had the privilege of working in various centralized and strategic positions that enabled her to liaise with international executives. This position provided the researcher the opportunity to identify appropriate participants from different environments and also “provided purposeful sampling in which the research can discover, understand, and gain insights from a sample from which the most can be learned” (Merriam, 1998, p. 61). The selected participants work in the business, academic, and/or government sectors within the highest executive level or operate within one reporting line for the highest level; they may have titles such as CEO, CFO, or President. Thus, the researcher used “purposeful sampling and selected the participants in a non-random manner to identify the participants that fit the appropriate criteria” (McBurney, 1994, p. 203).

Many of the executives were chosen from the researcher’s personal network; however, the researcher relied on the ‘snowball effect’ to connect with other executives,

specifically to include a diverse group data set into the study. Table 15 outlines the criteria for the ideal participants. As part of the research assumptions, the level of systems thinking levels was not identified or measured. The executives who were chosen for the study were considered, as per Marshall and Rossman (2010), as “elites” (p. 155). Elites are stated to be individuals with “power and influence and are considered influential, prominent, and/or well informed in an organization or community and are selected for their in-depth perspectives” (p. 155). The presence of a systems thinking mental model was evidenced through the continual career progression of the executives within complex adaptive systems. The researcher did not select a participant who was not known to be successful in complex or ambiguous environments.

Methods for Assuring Protection of Human Rights

The researcher obtained approval from Teachers College, Columbia University’s Institutional Review Board and began to seek voluntary participants for the study. The participants were provided with an Informed Consent form that outlined the protocol title, introduction, purpose of the study, possible risks or discomforts from taking part in this study, specific emphasis focused on the protection of their confidentiality, and how the results will be used. The participants were informed of the aim and purpose of the study. The risk and benefits were also explained to the participants. Written consent was obtained from all the participants prior to the start of the interviews.

Table 15

Author's Participant Selection Criteria

Selection Criteria	Participant Context	UAE Business Context
12 Interview Participants	<ul style="list-style-type: none"> • 10+ years working in at least two defined CAS or ambiguous environments • Operating at senior executive level • Defined as a systems thinker as career progresses within the environment and given projects that require a systems thinker • Considered “elites” in their field (Marshall & Rossman, 2010) 	<ul style="list-style-type: none"> • Multinational stakeholders • Multiple business models within organization
6 Focus Group Participants	<ul style="list-style-type: none"> • 10+ years working in at least two defined CAS or ambiguous environments • Operating within one level of the senior executive level • Defined as a systems thinker as career progresses within the environment and given projects that require a systems thinker • Considered as “potential elites” as per Marshall and Rossman’s (2010) definition as the participants have worked alongside those considered the “elites” 	<ul style="list-style-type: none"> • Joint Ventures and Partnerships • Major and/or frequent external influences • Business, government and/or academic domains are interrelated
Not Selected	<ul style="list-style-type: none"> • Less than 10 years working in one or two defined CAS or ambiguous environments • Not operating within one level of the senior executive level 	<ul style="list-style-type: none"> • Complexity or ambiguity involved within a single business model • Minor or known external influences • Single domain focus

Confidentiality

To keep and maintain confidentiality for the participants’ information, the researcher used the following protocols for the interviews and focus group session. First, the signed Informed Consent forms were stored on the researcher’s personal computer in a password-protected file folder and kept on file for the required duration. Second, the participants who agreed to be part of the interviews were given coded names which were allocated to the interview recording(s) and any images that were provided during the

interview. Third, the interviews were recorded and placed with password protection on the researcher's personal computer and destroyed and/or given back to the participants upon their request. At such time that the researcher wants to use personal quote(s) from the participant that may form part of the interview, a future article, or book, the researcher will approach the participant for their written approval. Fourth, the researcher ensured that if any information is to be published, the content would not interfere with any UAE privacy or censorship requirements. The focus group participants, due to the format of group discussion, may have known each other based on the researcher's network and this potential risk of being able to identify certain members was clearly stated on the Informed Consent form. The researcher minimized the risk by aggregating the data and remove any identifying information from the final or published material(s).

Ethical Considerations

The researcher completed the Collaborative Institutional Training Initiative (CITI Program) as part of the doctoral program in which she passed all nine modules that entailed the History and Ethical Principles course. The research study intent was to provide a context for current and future research on systems thinking mental models and safeguard the participants' interests for agreeing to volunteer for the study. It was expected that the interviews would contain personal information that should not pose a risk to the participants' personal or professional interests. In cases where the participants feel their Informed Consent rights were not being exercised, the researcher may risk her doctoral approval status. Thus, the researcher ensured that all ethical considerations such as age, race, gender, religion, or sexual orientation were not addressed in any way that would be construed as being in violation of ethical considerations.

Methods for Data Collection

Semi-Structured Interviews

The semi-structured interviews were the main source of the social science qualitative data collection as the interviews provided the rich context between the researcher and the participant. The interview questions were prepared and provided to each participant ahead of the interview. The interviews were to be virtual or face-to-face; however, each interview was recorded, and the researcher took notes after the interview to ensure both that accurate wording was captured and the researcher's perceptions of the environment and participant's demeanor were noted during the interview. The in-depth interview focused on the individual and provided an opportunity to address complex experiences and the participants' unique perspectives. The interview process allowed for storytelling, examples to be provided, and tangents that the participant may have provided as contextual evidence to the discussion (Yin, 2014). The strength of the interview was if the participants felt the interview was part of an insightful conversation in which they felt they had the time to reflect and capture their thoughts that were relevant to the interview questions.

Focus Group

While semi-structured interviews are conducted one-on-one, focus groups seek to elicit information from the interactions of the participants within the research environment. The researcher approached six participants who were identified as 'potential elites' as per the selection protocols, who also work in CAS, to understand more about their thinking patterns. The design of the focus group activity was concept

mapping to introduce systems thinking experientially. The activity was introduced to the participants as an activity to use concept mapping to explore a complex or ambiguous issue(s) the participants may have faced in the workplace. The participants developed a concept map based on their knowledge of the factors that affect the components of the map. The researcher encouraged the participants to work through the situation by highlighting the elements, interactions, and feedback components within the map. The participants then completed the five questions on the sheet and each participant presented his or her responses to the focus group questions in a roundtable discussion format. The focus group categories were analyzed and distilled into main codes. The focus group main codes were validated against the semi-structured interviewing coding to triangulate the data for validity, which may add further insights into a systems thinking mental model through an illustration and discussion format.

Demographic Information

The researcher collected demographic data from the interview and focus group participants according to data that were entered into the Qualtrics survey format to analyze for bio data. The demographic questionnaire was provided to the participants at the end of the interview or focus group. The collected data provided insights into the type of background, educational level, or languages spoken that enabled the development of a systems thinking mental model.

Methods for Data Analysis

Coding and analysis of the data can be considered one of the most interesting steps within the research study. Data analysis can be described as the “process of making

sense and meaning from the data that constitute the findings of the study” (Merriam, 1998, p. 178). This process entailed “pulling information from the literature review to verify the key concepts and the participants’ responses to the research questions to manage, analyze and interpret the data” (Marshall & Rossman, 2010, p. 84). The researcher implemented a ‘self as instrument’ methodology to ensure a holistic view of the collected data (Creswell, 2009). The researcher loaded the transcripts into Dedoose, the data analysis software tool, and began to review the content from the conceptual framework lens or theory-generated codes (Auerbach & Silverstein, 2003). The software was used to analyze data and identify and synthesize patterns. The researcher conducted the analysis by “classifying similar ideas, concepts and themes with the goal to generate a set of categories that represent a realistic reconstruction of the collected data” (Ary, Jacobs, & Razavieh, 2002, p. 466). The following preliminary categories (theory and conceptual codes) were identified:

1. Individual: experiences, perceptions, behaviors, and reflection
2. Organizational: interconnected systems, interconnected relationships, patterns and self-organization, and fluid agents
3. Environment: situation and dynamic environment

The names of the categories reflect the preliminary conceptual framework; however, the analysis phase allowed the researcher to conduct the coding organically as well as to make sense of the data and look for recurring patterns that may not have been captured through the original coding scheme. This iterative process was conducted to ensure validity and reliability.

Through the coding phase, the researcher used color codes, phrases, and words to indicate alignment with the conceptual framework and added comments with the coding mechanism to indicate ‘why’ the transcript phrase was coded that way it was. Through the interaction process, these comments provided insights into how the coding scheme may have changed based on the researcher’s own perception and interpretation of the data over time as potential new patterns emerged.

Validity and Reliability

“Validity is a test of whether the collected data accurately gauge what is being measured” (Denzin & Lincoln, 2000, p. 302). Lincoln and Guba (1985) stated that “credibility can be intact if certain techniques, methods and or strategies are employed during the conduct and the inquiry” (p. 322). Creswell (2013) supported this premise and stated the term *validation* as a “process to assess the accuracy of the findings, as best described by the researcher and the participants” (p. 248). Strategies to enhance validity include conducting a qualitative inquiry and a combination of methods.

The researcher conducted triangulation of the data, which is when the “researcher compares different data sources, methods or data types” (Creswell, 2013, p. 251). For the purposes of this study, triangulation from multiple data and literature sources was used to enhance the findings. The researcher supplemented the semi-structured interview data with the focus group session and demographic questionnaire data. Only after the focus group data were collected and synthesized was the coding analyzed alongside the interview coding scheme to verify validity. The purpose of using triangulation was to address any inherent biases from the data sources and evaluate the accuracy of the

interpretations. Yin (2014) stated, “use multiple sources of evidence” as part of the triangulation process to avoid having only one source of evidence within the research study (p. 118).

The researcher intended to use the focus group sessions to validate the interview data by using the focus group methodology in order to observe the group interactions as they worked through an ambiguous work situation through the systems thinking mental model lens and discussed their findings. The focus group outcomes provided insights into two main areas for the interview analysis: thematic coding similarities and images that provided powerful insights into the systems thinking mental model formulation. The images were cataloged within the full dissertation findings.

The term *reliability* “refers to the stability and consistency of the research process over time” (Creswell, 2013, p. 246) and “the degree of error that exists when obtaining a measure of a variable” (McMillan & Wergin, 2002, p. 10). As no measure or instrument is accurate, reliability in qualitative studies should be determined by the results that are consistent with the data collected. The researcher implemented the following processes to seek reliability: (a) replication logic: the researcher conducted the study with multiple participants to ensure there is a point of potential data saturation; (b) the coding strategy was conducted over a period of time to ensure consistency of the coding strategy; (c) the data were observed by multiple peer coders to check the consistency of the researcher’s coding strategies; (d) the researcher continued to review systems thinking mental model literature and experts to check the consistency of the patterns of data; (e) the researcher declared her position of interest and professional experiences in the topic; and (f) the researcher provided more than one method to collect data.

For the operational reliability portion of this study, the researcher used the Dedoose data analysis software, which provided an opportunity to have additional coders code the same data in isolation. The purpose of having doctoral students familiar with the coding process conduct an independent coding exercise was to verify if there were any hidden assumptions and biases from the researcher in the original coding scheme. The process included having two independent doctoral students conduct the coding analysis for two transcripts. The researcher conducted a Skype call to discuss their findings and used the insights to verify if the original coding scheme required modification based on the coding feedback. Additionally, the researcher conducted periodic calls with her advisor and discussed the preliminary findings to ensure the coding scheme had utilized a wide-angle lens to understand different interpretations of the data.

Limitations

Merriam (1998) stated that the “human instrument is as fallible as any other research instrument” (p. 20). Thus, there are limitations to the research study: the researcher’s ability to probe into the executives’ mental models and the participants’ ability to describe their own mental models. This study was based on complex cognitive aspects and the research process provided the executives with the research questions and terminology prior to the interview; the researcher was resourceful in the interview probing to elicit the executives’ narratives that conveyed their ‘thinking about thinking’ strategies.

The second limitation of the study was to address how the participants were chosen as ‘systems thinkers’ beyond the selected criteria listed in Table 15. Due to the

exploratory nature of the study, the different responses, diversity of the group, and potential language and/or understanding of the concepts may have been inhibiting factors because of different meanings and interpretations for the researcher and the participants. The researcher was required to continually probe and question meaning and descriptions to verify the narrative was as per the participants' description.

Chapter IV

EXECUTIVES IN COMPLEX ADAPTIVE SYSTEMS

The purpose of this chapter is to introduce the context of the executives' complex adaptive systems (CAS) within the United Arab Emirates (UAE) to provide readers with an appreciation of the depth of ambiguity and uncertainty of the participants' role and use of a systems thinking mental model within their organizational and environmental setting. The chapter describes the structure of each executive's domain and the components of complex adaptive systems to provide context for CAS in order to help distinguish the difference between CAS and complex companies, as complexity comes in a variety of forms and not all complex companies are complex adaptive systems (Levin, 2002). The company domains are described within the UAE context while ensuring that executives' identities and company identifiers remain confidential. Twelve executives working within the UAE who participated in this interview research study work in 11 different domains that include: education policy, healthcare, oil & gas, renewable energy, e-commerce, cyber security, real estate development, marine & shipping, banking & investment, conglomerate, and leadership consultancy.

UAE Context

Through research and understanding of the prolific growth of the UAE in recent years, each of these domains has been transformed and adapted to rapid growth and change initiatives and the blending of corporate and government alignment, and/or they have also participated in large-scale global mergers. These dynamic domains are deemed adaptive and evolving in the changing landscape, with limited separation between the system and the environment with emergent properties.

The emergent properties stem from government interactions, interconnectivity, and interdependencies that dictate rapid responses to avoid stagnation. The executives were selected as they were key decision makers within CAS and agreed to participate and share their perceptions of how they learned to develop a systems thinking mental model to manage ambiguity and uncertainty. Supporting the CAS components within the various UAE domains, HH Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, Supreme Commander of the UAE Armed Forces, and HH Sheikh Mohamed bin Rashed Al Maktoum, Vice-President, Prime Minister of the UAE, Ruler of Dubai, and Minister of Defense chaired a meeting in 2017 and announced over 120 initiatives for 30 pillars in the presence of over 450 government officials. The wide scope of UAE initiatives covers all 11 of the researcher's domains and more (*The National*, 2017) which support the relevant UAE domains as complex adaptive systems.

Education Policy

Starting with the education domain, in recent years, the UAE government has invested significant funding in building a knowledge-based economy, and education is

considered a key component for transforming the country. In terms of growth, the UAE, specifically Dubai and Abu Dhabi, are posed to increase the number of private school students from 500,000 in 2018 to over 800,000 by 2021, a 62.5% increase in private schools alone (export.gov, 2018). The government's vision within the Ministry of Education Strategic Plan (2017-2021) is not only to increase growth, but also to revamp the curriculum, strengthen the professional development of teachers, develop and train more UAE teachers, develop smart learning programs, and introduce more STEM initiatives at the elementary level (Government.ae, 2018). The Ministry of Education (MoE) has launched an ambitious plan in partnership with the Abu Dhabi Education Council (ADEC), Knowledge and Human Development Authority (KHDA), and other entities to enhance the quality of education in the UAE (export.gov, 2018). Truly remarkable changes include corporate and academic partnerships that seek to increase knowledge for new technology and innovation platforms to address intellectually stimulating topics such as robotics and artificial intelligence with evolving learning tools and delivery methods.

In essence, UAE education is taking a systems thinking approach to redefine education and schools as dynamic and adaptive, not rigid and invariable institutions (Fidan & Balci, 2017). The executive interview participants are part of the UAE reform strategic plan and were seeking to change the standard Arabic education system into a complex adaptive system, whereby the revised curriculum reaches beyond the school walls into the social systems and environment by creating an open system with widespread interests in the corporate, government, and academic fields to create a new

understanding of learning and development. The executives worked with the relevant Ministers to propose and implement forward-thinking education policy strategies.

Healthcare

Complex adaptive systems include a large number of interacting elements that interact with one another in a non-linear fashion. As such, global perspectives and new technology in healthcare are helping to transform the business of healthcare delivery and management. In the UAE, massive infrastructure changes have aimed to increase the level of care as world-class medical facilities such as Cleveland Clinic, London Harley Street, Imperial College London, and other strong medical science research bodies were established that enabled strong public and private partnerships to upgrade the local standards, but also tackle the complicated challenges to develop international healthcare quality standards. The UAE's healthcare sector is currently witnessing structural shifts and poised to record a strong investment growth of 60% in the next 5 years to 103 M AED by 2021, according to research by Mena Research Partners (*Khleejtimes*, 2017).

CAS in healthcare, as it pertains to nursing and emergency practices and hospitals, have complex adaptive properties based on the dynamic state of decision autonomy (triage processes), interacting departments (agents), and emergent aspects such as diverse workforce, complex or non-alignment of information technologies, communication gaps during shift handovers, and the community at large—a diverse population with different backgrounds of healthcare standards. Additionally, the arrival of “artificial intelligence and robotics was developed to create an advanced ecosystem of new technologies, procedures and networks within the UAE and Abu Dhabi” (PwC, 2017, p. 7).

The executive involved in the research study had a centralized role and managed the complexity as it evolves from the dynamic behaviors of the networks of components within the facilities, including interactions with the hospital, patients and their families, and healthcare professionals in non-linear patterns that intersect with unintended consequences of emergencies, new technologies, medical errors, or even different cultures and traditions for various medical treatments.

Oil & Gas

Systems can be understood by looking for patterns within their complexity, patterns that describe potential evolutions of the system (Dooley, 1997). To that point, the oil & gas industry in the UAE can be seen as a CAS through the “many components that adapt or learn as they interact” and impact the UAE’s hydrocarbon landscape (Holland, 1995). The UAE has the world’s sixth largest proven oil reserves, the fifth largest natural gas reserves, and the third largest exporter of crude oil (Energy in the UAE, 2018). The oil & gas industry includes the private and government sector, myriad global stakeholders and partners for securing oil exploration, shipment, supply, and rapidly expanding electricity needs.

The executive was in a unique and strategic position within this industry as it interacted with all the oil & gas players on a global stage at the government and corporate level, and the executive was tasked with pursuing an energy program that provided a sustainable and profitable remit while strengthening and growing upstream exploration and the production sector.

Renewable Energy

When discussing oil & gas in the UAE, it may seem counterintuitive to be focused on renewable energy; however, the UAE's oil supply is a finite resource. As Sheikh Mohammed, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the Armed Forces, famously stated in a 2015 speech, "In 50 years, when we might have the last barrel of oil, the question is: When it is shipped abroad, will we be sad? If we are investing today in the right sectors, I can tell you we will celebrate at that moment" (*The National*, 2015). In accordance with the United Nations Framework Convention on Climate Change (UNFCCC), the UAE is a non-Annex 1 country and is not obligated to reduce its emissions (Embassy of the United Arab Emirates, 2018). However, the UAE has launched many government and corporate initiatives to tackle climate change and introduce a strong national energy strategy to expand the UAE's commitment to low-carbon technologies, innovation, and policy reform as it seeks to diversify the energy economic market.

The executive worked within the corporate and government sector of renewable energy and plays a pivotal role to build the energy domain from the national policy angle and the innovation and technology energy efficiency space. The executive's remit included the research, development, and deployment of various renewable energy sources such as wind, solar, geothermal, and nuclear. The executive employed a systems thinking mindset to manage the fluid and dynamic elements, complex stakeholders, new technology, and economic shifts to provide climate change initiatives.

Cyber Security

In a world of ever-changing system interdependencies, the emergence of cyber security is deemed CAS as new policy design, national security, and new technologies; the impact of the social technical introduces new types of interactions and agents to the domain, with frequent shifts in how we know, understand, and manage cyber security mechanisms. For example, new software and cyber activities, such as cyber attackers and the defenders, continually force change within this dynamic and self-organizing domain. Similarly, a CAS is made up of “interacting components (agents) that adapt their behavior overtime in reaction to changes with respect to their environment and to each other” (Holland, 1995, p. 93). The disruptive nature of cyber security dictates that the system itself must undergo purposeful change to adapt to new environments.

The executive was charged with leading the cyber and information security domain that builds partnerships and technology platforms within the corporate, government, and academic realms. The business model was continually adapting to the regional demands to remain in the forefront of new demands.

E-Commerce

The UAE is ripe for embracing megatrends and the growth of the e-commerce market is reshaping how the UAE interacts with the economic environment. In 2015, Gulf Cooperation Council (GCC) stated that the e-commerce was worth \$5.3 billion and the UAE was valued at \$2.5 billion. The GCC e-commerce is expected to quadruple to \$20 billion by 2019 and the UAE to hit \$10 billion by 2018 (export.gov, 2018). E-commerce is considered CAS due to the various government interactions to regulate

the region's e-commerce sector, the suppliers, and import and export tariffs, as it interacts with the consumers' need for technologically advanced interfaces and spending power.

The executive was working in a centralized position in e-commerce and in a leadership position, and sought to pull together all the relevant stakeholders to create competition with the known e-commerce giants for the Middle East region.

Real Estate Development

Complex adaptive systems are systems that also “absorb external pressures and can be significantly altered by minor influences” (Fioretti & Visser, 2004, p. 14). This is evident in real estate development in the UAE as Deloitte 2018 Middle East Real Estate Predictions study stated that Dubai real estate will become more connected than ever to the global economy; Dubai's development finance market is evolving and becoming more diverse, disruptive technologies, such that the “construction and supply of commercial, industrial and retail properties as well as the provision of infrastructure is now subject to VAT and represents one of the biggest challenges for Dubai's real estate industry” (Deloitte, 2018a, p. 15).

While real estate development can be seen as simply a complex environment, the executive in the research study was involved in projects and investments that reach into the billions of dollars and interacts with the highest level of international governments and corporate executives within progressive and emerging markets. While small changes to an infrastructure design can have large and unexpected effects on a building performance, it is when the large-scale real estate development seeks to create a robust economic shift through a master plan that it may impact demographics, lifestyles, and investment opportunities. Seeking to diversify the economy, it can be classified as a CAS.

Marine & Shipping

The UAE ports and terminals operate in the highly competitive, logistical network of globally connected industries that seek to move goods and supplies and have the capacity to stimulate development, trade, and diversification within the UAE. While shipping relies heavily on “logistics, structure, predicted operating patterns and technology to move 90% of the world’s goods” (Caschili & Medda, 2012, p. 11), the industry is highly connected to a large number of independent elements (agents) such as port authorities, shipping service providers, and shipping companies, as it intersects with “economic volatility, disruptive weather issues, new technologies and changing international trade agreements” (p. 2).

The UAE is strategically placed to capitalize on its growth as it is positioned between Asia, Europe, and Africa on the north-south axis, with a potential market of over 2 billion people within 4 hours travelling time and remains a vital domain for the UAE’s economic system (UAE Imports & Exports Guide, 2014). The UAE has doubled in population growth from 4 million in 2005 to over 8 million in 2010 and has now reached over 10 million residents (UAE Imports & Exports Guide, 2014). The maritime shipping domain must be continually learning and adapting large-scale, state-of-the-art logistic hubs to manage the country’s growth needs.

The executive in the research study was tasked with building the UAE shipping network with international economic alliances, forecast for future international pricing and shipping strategies, and navigate through new and changing international trade agreements to leverage better access to trade channels.

Banking & Investment

The banking & investment sector has long moved away from the traditional worldview that a financial action can be made in isolation and stable, probability assessments, and linear processes are fixed to predict the economic environment. Rather, investment banking is considered a CAS in which financial interactions are interdependent experiences and have significant uncertainty in probability assumptions. Moreover, markets have seen how even internal corporate decisions, such as those at Enron, can potentially collapse a market.

The investment industry in the UAE in recent years has undergone a massive shift to merge major national banks to create economics of scale for aligned business investment opportunities. “The Middle East is one of the world’s fastest growing markets in the banking and capital markets sector” (PwC, 2017, p. 7). The “metamorphosis is due to complex and diverging regulations, legacy systems, disruptive models, cybersecurity and technologies, new competitors and changing techno-savvy customers” (Deloitte, 2018, p. 1).

The executive interviewed from the banking & investment domain was operating at the highest strategic level of a major national bank and is faced with an ever-increasing number of financial options (agents) critical to the dynamic global economy. The executive understands the need to scan the entire financial global system to seek an understanding of the whole systems behavior in order to make quality financial decisions.

Conglomerate

The privately-owned holding company controls the family’s operating subsidiaries, joint venture companies, strategic partnerships, and private equity. This

company is considered CAS due to the integration of private, government, and academic links that form the partners of this global holding company and the value it provides to strengthen the UAE's network and integration of new technologies and economic growth opportunities. The pressure to maintain the dynamic family business and manage the influences on economic factors.

The executive operated in the centralized role to meet all the stakeholders, be they the government, academic, or private sector from multiple domains, such as telecom, security, renewables energy, real estate, and infrastructure development.

Leadership Consultancy Training

Information processing, entrepreneurial activity, and social networks generate value within CAS and explore the link between people, systems, and behaviors. The participant in the leadership consultancy domain is working within the entrepreneurial activity within a CAS system due to the overarching change that is occurring in the UAE for learning to adapt to the micro and macro societal changes that occur when developing a knowledge-based population. Corporations are continually seeking consultancy assistance on how to cope with and through the change. Additionally, the introduction of Free Zones, changing tax, and ownership laws have made being an entrepreneur risky as well as advantageous because small and medium-sized (SMEs) businesses must continually adapt to market needs and scan the environment to meet business expectations.

In this domain, feedback loops are important to recognize and to identify important information learning cues for change and avoid isolation from lack of knowledge sharing. Argyris and Schon (1978) stated that double loop learning is required

as business leaders must recognize when change is required. However, forecasting for business leadership needs is seemingly impossible if even the business does not anticipate it. Thus, the executive in the research study was building a learning organization for itself and other organizations and is, in itself, continually evolving and learning to manage the unpredictability of corporations' learning needs.

Summary

Chapter IV provided information regarding the 12 participants and the 11 different complex adaptive domains as it pertains within the United Arab Emirates. The domain descriptions included the various interrelationships between government, corporate, and academia and the large-scale shifts and growth disruptions in the market that provide the executives with unique and uncertain scenarios. Chapter V will provide insights into how the executives describe how they think and learn with the ambiguity to develop a systems thinking mental model.

Chapter V

RESEARCH FINDINGS

The purpose of this exploratory research study was to seek what is known about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of 12 global executives working in the United Arab Emirates (UAE) within complex adaptive systems (CAS) and their understanding of their thinking patterns that may have assisted in learning how to develop a systems thinking mental model to manage business ambiguity. This chapter provides the four key findings that emerged from the participants' semi-structured interview responses in relation to the research questions, analysis of the demographic questionnaire, and findings from the focus group discussion. This research examined the elements involved and their learning strategies to develop a systems thinking mental model. The research findings are presented in alignment with the three research questions and relevant executive narratives can be found in Appendix A to understand more about the executives' systems thinking mental models.

The research findings are identified by the key elements of the finding based on the data collected in response to the interview questions. First, the executives' excerpts were reviewed in alignment with an adult learning theoretical understanding and verified if the data indicated a contribution to a relevant body of research. Second, the researcher

shed light on any identified patterns, connections, surprises, or gaps that emerged from the data analysis.

Research Findings Overview

The exploratory qualitative research study was conducted through semi-structured interviews with 12 executives working in the UAE in complex adaptive systems. As noted in Chapter III, Methodology, each transcript was coded through three coding schemes. The first coding scheme was classified as deductive coding, using systems thinking elements aligned with the conceptual framework elements, which were created by linking literature review collated concepts. Level 1 coding included six main deductive codes with 35 subcodes, or approximately five subcodes per theme. The second coding process involved the In Vivo Coding process, in which 10 main inductive codes were created with a total of 74 subcodes, or approximately seven subcodes per theme, and resulted in multiple transcript references from each executive in each of the categories. The Level 2 coding exercise provided the researcher with confidence that the second coding criteria was on the right track for consistent narratives within each coding category. Level 2 coding was further refined by seeking three words for each category to understand “what is happening here” (Charmaz, 2006, p. 57). The ‘three-word’ identifiers for each category became the focus for the third level of coding. Level 3 coding was developed to create a different method of viewing the data based on understanding the Level 2 coding themes and provided succinct codes for understanding the data.

In alignment with the coding process, the researcher conducted a secondary literature review to verify if any new research had been published during the interim

period between the research proposal hearing and after the final interviews were completed—a span of approximately 8 months. The researcher identified two significant research papers that provided insights for Finding #1, Reflective Thinking and Practices. The paper “Conceptualizing Reflection in Experience-Based Workplace Learning” (Lundgred et al., 2017) explored Tara Fenwick’s five complexity perspectives of reflective cognition. The released article provided further insights into reflection thinking based on the different cognitive complexity perspectives in order to verify a potential coding scheme. However, based on different data collection methods required for the five cognitive complexity perspectives, only the reflection: constructivist perspective and, potentially, the psycho-analytic perspective would be appropriate perspectives to analyze due to the semi-structured interview data collection methodology. Nonetheless, the researcher continued to review the data through the ‘reflective lens’ as she identified over 50 different executive interview excerpts indicating reflection thinking or practices that may be prevalent within the executives’ mental models.

The second article was “Rethinking Informal and Incidental Learning in Terms of Complexity and the Social Context” (Marsick et al., 2017). The article was relevant because an updated learning model was introduced and provided additional information on informal and incidental learning as it related to social context and complexity. The researcher used the new information to update the literature review.

The data analysis continued to be explored and the researcher identified narrative evidence of a ‘thinking and action’ modus operandi within the executives’ narratives in which ‘behavioral action’ identifiers emerged from the data. This insight was integrated into two of the findings.

First, the reflective nature of the executives' thinking strategies, from the researcher's perspective, was not simply 'reflective insights' but rather 'reflective practices,' as the researcher found evidence that the executives sought to transform insights into practical and actionable strategies. A second major insight led to Finding #2, Learning Architecture Elements, in which the researcher found narrative evidence of adaptive mental models and action-orientated behaviors as part of the executives' learning landscape and critical components included in a systems thinking mental model.

Further insights were identified through the form of aggregated data where salient narrative references were coded, compared, and measured for frequency. This provided insights into two findings: Finding #3, Type of Experiences, that may lead to the development of a systems thinking mental model; and Finding #4, Ambiguity Thinking Strategies, which provided a summary of Findings #1-3 and detailed the executives' final thoughts on what action, elements, and behaviors future leaders should incorporate to learn how to develop a systems thinking model. Additionally, the executives' significant narratives were plotted into charts (Appendix A) and further analyzed across the excerpts to verify alignment with the Findings Categories in which minor coding scheme headers were edited to provide richer clarity. The researcher also reviewed the findings from the Focus Group session to verify the meaning of causal map exercise outcomes through the discussion.

The focus group exercise served to triangulate the semi-structured interview findings to verify if any alignment with the interview data. The researcher invited six executives, as per the focus group target audience criteria, and conducted a systems thinking causal map exercise and discussed five questions similar to the executives'

interview questions. The identified elements for each scenario were explored as a group. The most salient points from the focus group session summary and causal map illustrations were analyzed with the Level 3 coding scheme.

To explore the systems thinking learning pathways used by executives working in CAS to develop a systems thinking mental model, the researcher asked a series of questions related to describing their thinking strategies, beliefs, principles, and perspectives. The research study four major findings proposed through various data collection methods in this study includes:

Finding #1: Each of the executives exhibited reflection thinking and practices as part of their mental model (beliefs, perceptions, and principles) that assisted the executives through unfamiliar challenges.

Finding #2: The executives employed adaptable mental models with key action-orientated behaviors as part of their learning and knowledge-seeking architecture within ambiguous situations.

Finding #3: All executives in the study indicated three similar types of experiences involving challenges, behaviors, and dilemmas that provided critical learning moments, within various degrees, within the internal and external work environment as integral to learning how to develop a systems thinking mental models. This included: (a) ambiguous situations, (b) exposure to alternative ways of thinking, and (c) challenging assumptions.

Finding #4: The executives in the study summarized five ambiguity thinking strategies to learn how to develop a systems thinking mental model: (a) be curious, (b) build a community/networks, (c) develop comfort in the

unknown, (d) ensure diversity of thought, and (e) seek to understand person, context and environment.

Four Key Findings

Finding #1: Reflective Thinking and Practice: A Component of a Systems Thinking Mental Model

The research question, *What characterizes the mental models the executives hold? (i.e., the distinct nature or features of their beliefs, behaviors and principles)*, was explored through the interview questions that sought to understand the executives' background, perceptions, and beliefs through their narratives and descriptions of complexity, uncertainty, and ambiguity. The information captured was *How do the executives' beliefs of ambiguity influence the development of a systems thinking mental model?* and *What are the thinking strategies the executives employ to make sense of ambiguous or uncertain situations?*

As noted in the adult learning literature, “reflective practice allows one to make judgement in complex and murky situations based on experience and prior knowledge” (Merriam et al., 2007, p. 185). Merriam et al. further stated the “intention of reflective practice includes our past and current experiences to gain a deeper understanding (of the situation) and a higher-level thinking process” (p. 172).

A large portion of the interview discussion was centralized on the executives' mental models and their meta understanding of their ambiguity thinking strategies while working within CAS. Thus, the first key research finding of ‘reflective thinking and practice as a component of a systems thinking mental model’ was analyzed in three areas:

(a) understanding of the finding, (b) excerpts showcasing explicit narratives in reference to reflective thinking and practice activities, and (c) analysis of the data.

Understanding of the finding. As noted, the researcher indicated that there was evidence that 100% (12 of 12) of the executives exhibited reflective thinking and practices as part of their mental model (beliefs, perceptions, and principles) that assist the executives through unfamiliar challenges. While this type of finding from the data from the adult learning theory perspective would be logical and relevant as ‘reflective thinking and learning’ is one of the main components of many adult learning theories (Boud et al., 1985; Dewey, 1933; Fenwick, 2000; Kolb, 1984; Marsick & Watkins, 1994; Yorks & Nicolaidis, 2013), the researcher noted that reflective learning has limited mention within many of the main systems thinking conceptual frameworks. For example, as noted in Chapter II, Literature Review, in Table 4, Collated Systems Thinking Concepts, the concept of ‘reflection’ is not included, as the table indicates only the following key concepts: (a) wholes rather than parts, (b) feedback loops, (c) open systems, (d) dynamic behavior, (e) systems structure as the cause of behavior, (f) non-linear relationships, (g) interconnections/interrelationships, and (h) dynamic systems and patterns of change.

Noting that the inclusion of the adult learning lens within the research helped to identify the concept of reflection is an important point as the researcher found the executives were able to derive meaning from complex experiences to learn how to manage ambiguity. Essentially, by using the learning from experience lens, the concept of reflection may indicate a strong link between thinking and learning as it pertains to systems thinking and mental models.

The next section provides interview excerpts and theoretical commentary of reflective thinking and practices, as evident to the researcher from the data and coding scheme.

Excerpts showcasing explicit narratives in reference to reflective thinking and practice activities. The descriptive narratives indicated that reflective thinking and practice evidence emerged from the data. The following section includes different aspects of reflective thinking and practices as described by the executives as being integral to a systems thinking mental model. The excerpts and description of the interviews presented a journey through the executives' mental models and potentially add insights into a connection to the adult learning theory of reflection and reflective practices and a systems thinking mental model in two areas: (a) employs a reflective constructivist perspective, and (b) conducts reflection practices.

Employs a reflective constructivist perspective. Constructivism through reflection is the cognitive ability (confidence and independence) to make meaning from one's action in the world (Piaget, 1966; Vygotsky, 1978; Wells, 1995); thus, "reflection is deemed the primary actor in the process of knowledge construction" (Fenwick, 1999, p. 2). Furthermore, Schon (1983) noted that constructivism is to understand workplace learning by noticing and framing problems of interest in a particular way and then inquiring and experimenting with solutions. Through coding of the transcripts, the researcher found evidence whereby 100% (12 of 12) of the executives employed a constructivist perspective in which their knowledge was constructed through reflection

during and after an experimental action on an ill-defined or messy problem (Fenwick, 2000).

The executives' narratives showed evidence that they were attempting to construct knowledge, transfer the knowledge to new situations, and make meaning of the new situation in response to past experiences in order to understand ambiguous situations. Schon (1983, 1987, as cited by Fenwick, 1999) stated the mental process of reflection during, in, and after action is considered an important element of constructivism. For example, CHARLIE002 stated very casually and comfortably with regard to the dynamic changes that occur in complex adaptive systems:

Everything was very ambiguous and since I was so embedded in the world, I just assumed that I'm creating my own universe. If you have that approach to life and to your work, then of course you get very intimate with the activity and what's going on.

CHARLIE002, part of the 71% of executives who had master's degrees, also spoke three languages and had lived as an expatriate for over 20 years in at least three different countries. This global experience may provide evidence of creating meaning in different contexts in order to understand the changing reality. Supporting the cognitive ability to make meaning of unique information, KILO001 stated the following when speaking with his counterparts on a very complex and unique hypothetical question:

Then I asked the two presenters a question, and it was evident that they didn't have a readily available answer. One of them was already leaning towards an 'it depends' type of answer, until the second presenter said more simply, 'I don't know' and he earned my respect right there. I value this simplistic and directness.

KILO001 noted further that 'it depends' is a phrase used frequently within KILO001's work domain due to emergent agents that influenced the business model regularly.

ROME001 also reflected on creating meaning when faced with a puzzling pattern of events related to ambiguity:

You have principles, you know, you have hindsight. A perspective. If there is no precedents, if you try hard enough, you will find that even if you set your imagination on whatever information you have available, you can compile imaginary precedents. And just provide context for the situation. It sounds mad (*laughter*). So I think history is important and being able to recognize patterns.

MAMA001 reflected on new and uncertain situations, how to make meaning, and having situational awareness as follows:

Well, I think if you are an executive here [UAE] or somewhere else in the world where you're not necessarily from, it's a guarantee that you're going to have to spend a lot more time on things that maybe aren't—don't directly have to do with your business, but it has to do with being able to get inside and understand what's going on around you. If you don't understand it, you can't anticipate it; then everything will be unexpected.

The executives are highly regarded experts in their domains and have years of progressive successful achievements; however, the executives still described inner reflective moments (some painful) that spoke to their ability to self-analyze and decode their mental models as a learning process with stunning humbleness and honest thoughtfulness with a form of action from the reflection. The executives reflected on the interview question, *Tell me how your beliefs and perceptions of ambiguity may have influences how your systems thinking mental model may have been formed.*

CHARLIE002 stated:

I've had the opportunity to think about that question because I was wondering why I could manage these multicultural environments and the bit of chaos navigation. It has to do with my childhood actually. It turns out that having no dad and living in a ghetto is a real good teaching experience. Realizing that crisis is a part of every day, that in the worst situation almost nobody will agree with your point of view and then maturing to the fact that there's a reason for that and then learning how to deal with that.

In response to disturbing moment(s) in which the conscious mind is forced to notice contradictions of experiences (Fenwick, 1999), the executives may have constructed a humble self-reflective description of their development of a systems thinking mental model as it related to their career progression. MAMA001 stated:

Well, what resonated with me is like you know.... I thought the way you progressed in your career is based on knowledge and technical abilities and slowly you find out there's a lot of other things that has to do with how far you actually get. Your basic expertise gets you to a certain level and then you realize that you actually don't know that much and there's a lot that you haven't tapped into.

Reflective learning can occur in different or unique work situations when the learning activity involves interaction or when the executive develops the ability to take cues from the contextual situation and integrate them into a new situation, as DELTA001 stated:

That was a stunner to me. I was in a whole different culture [UAE] and now reflecting, I didn't get it. I didn't quite understand how these people work, the politics of it.... It was some rough roads and I got used to it and I adapted. Part of the adapting was learning how structurally things work, how decisions were made, also what autonomy that you have.... I learned through experience.

Conducts reflective practices. The origins of reflection and reflective thinking stem from John Dewey (1938), the academic pioneer in the exploration of experience, interaction, and reflection. In *How We Think*, Dewey (1997) explored the process of reflection and stated, "reflection is a particular way of thinking and cannot be equated with mere haphazard 'mulling over'" (Rogers, 2002, p. 849).

The executives were requested to reflect on their experiences and find examples of how they might have developed their systems thinking mental model; thus, the 'reflection on experiences' excerpts during the interviews were expected and prevalent within the narratives. However, through further exploration of the *intent* of the retelling

of their experiences, it is important to point out that 100% (12 of 12) of the executives pointed to evidence of reflection practices as part of their modus operandi while working through complex and ambiguous situations. For example, each of the executives provided context to their experiences by mentioning their cognitive reflective practice descriptions. This was evident when MAMA001 was describing a board meeting in which the board members did not seem to be understanding or accepting the proposal. MAMA001 had stated that the proposal was comprehensive and logical, and provided the board members with enough information and context to deliver a swift proposal approval. However, MAMA001 noted the diversity and cultural differences of the board members and pondered if the 'comprehensive and logical' manner of presenting the proposal was the best way to gain approval. MAMA001 noted with 'self-reflection' the feeling of frustration and described the coping mechanism:

I guess (during those moments) you run up your personal hill to the top and scream. (*laughter*) and then let the dust settle and I try to reflect it back.... So, I try to find out the frustration and reflect on that.

Other executives provided narratives that pointed towards 'after-action reviews' as corporate learning and reflection mechanisms. LIMA001 stated the team does regular meetings in which proposals and debate are a regular practice, and ALPHA001 described how the 'safety huddle' practice promotes a 'blameless' culture by ensuring that speaking up about mistakes is encouraged. ALPHA001 also cited the best practice to create a corporate culture whereby if an employee covers up an error and the error is uncovered, the employee loses his or her job. In certain corporate cultures, after-action reviews are still seen as painful events as it is difficult for many executives to admit that problems

occurred during a project. Interestingly, HOTEL001 was energetic when discussing thinking strategies on how to manage difficult projects and was supportive of after-action reviews with the team. HOTEL001 stated with a smile, “I’m massively curious to figure out why we did what we did.”

The reflective practice is to reflect on the behavior as it happens and it is instinctive for the executives as they recognize the patterns and changing dynamics while they are in the evolving situation to select or deselect a course of action. For example, CHARLIE002 described a cognitive thinking process when discussing reflection thinking techniques as it pertained to noticing paradoxes:

It’s a really interesting paradox, in fact where the partners are going faster than the governance. That doesn’t happen too often. You have a sense of urgency, in the middle of that, using my experience, I’ve realized something else gets unlocked in my head.

The executives’ cognitive meaning making was evident during the interviews with multiple examples of reflecting during action and retrieving information from memory and then transferring the knowledge gained into new complex situations (Lundgren et al., 2017; Schon, 1993). KILO001 is a seasoned executive who was quick to use analogies or discuss past experiences to help formulate an understanding of a current, unique problem. KILO001 described this cognitive ability by using an analogy: the act of downhill skiing to visualize a solution to a fast-moving corporate dilemma. As KILO001 stated:

When you race in alpine skiing, you visualize every turn. You need to see yourself going thru every turn and assess how you’ve performed so far, and what you need to do in order to prepare and adapt for the next turns. One of the things that was very important for me as racer was to learn how to visualize the entire race. Each race is comprised of around sixty turns, and each is an opportunity to excel or to fail. You’re constantly adapting your approach.

Analysis of the data. Figure 10 presents the aggregate of the researcher's data regarding identification of reflection thinking and practices as it applies to the executives' explicit narratives provided during the interviews in three categories: (a) conducts reflective thinking and practices to make meaning of experiences, (b) awareness or usage of reflection techniques, and (c) found ambiguity thinking benefits through reflection.

The data indicated that while all the executives exhibited evidence of conducting reflection thinking or practices, only 75% (9 of 12) executives provided explicit descriptions of their awareness or usage of reflection techniques. Three of the executives work in semi-isolated CAS positions and may not be explicitly aware of their reflection abilities or mechanisms when asked during the interview although 100% (12 of 12) of the executives did display evidence of 'making meaning' through the narratives when describing past experiences. Additionally, 92% (11 of 12) executives were aware of their 'ambiguous situations' and how they used certain reflective techniques to identify the ideal decision pathway. The one executive who had the minimum amount of years working within complex adaptive systems as per the participant's profile criteria provided limited explicit descriptions of how the executive anticipates or manages ambiguous situations. This did not suggest the executive was not able to conduct ambiguity thinking strategies, only that the interview discussion did not elicit that type of response. Figure 10 provides the breakdown of explicit interview excerpts.

Summary. In summary of Finding #1, the data collection and executives' narratives exhibited reflection thinking and practice as a useful way to approach unfamiliar challenges by subscribing to the cognitive practice of making meaning of experience and/or utilizing corporate reflective techniques such as after-action reviews, or

feedback sessions to ensure interaction and continuity of experiences as a learning process. The executives provided evidence they learn by reflecting on experiences to test and strengthen key thinking patterns.

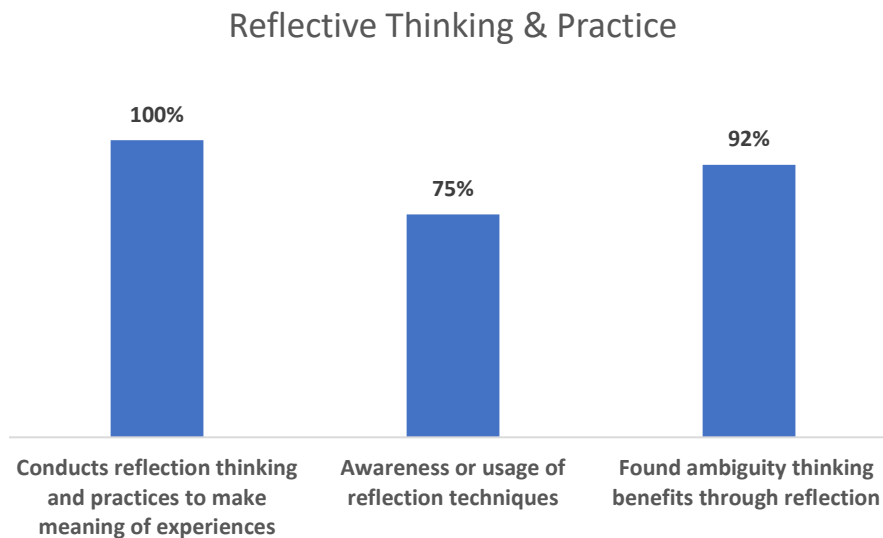


Figure 10. Author's reflective thinking and practice

Finding #2: Cognitive Learning Architecture: Adaptive Mental Models and Action-Orientated Behaviors

The first research question, *What characterizes the mental models the executives hold, the distinct nature or features of their beliefs, behaviors and principles?* was explored further with the objective of exploring the executives' 'thinking strategies' to make sense of ambiguous or complex situations. In Finding #2, evidence suggested the executives employed adaptive mental models as a key element of their learning and knowledge-seeking architecture and place emphasis in order to: (a) seek meaning through experiences and adopt sense-making attributes, (b) promote critical dialogue, and (c) fosters crucial connections to learn within ambiguous situations. As noted, a large portion of the interview discussion was centralized on the executives' systems thinking

mental model and their meta understanding of their thinking patterns while working within CAS. Thus, the second key research finding of ‘cognitive learning architecture: adaptable mental models’ is analyzed in three areas: (a) understanding of the finding, (b) excerpts showcasing explicit narratives in reference to adaptive mental models and action-orientated behaviors, and (c) analysis of the data.

Understanding of the finding. The interview questions were posed to elicit insights into the thinking and behavior regarding learning how to develop a systems thinking mental model. Mental models are based on perception, understanding, interpretation, and memory, and help to form knowledge and decision-making structures. In order to avoid heuristic thought patterns that may limit conscious thinking patterns, mental models can be updated, revised, or challenged when new, unique, or uncertain information or experiences are presented. Through a learning process, adaptive mental models can help one make sense of the situation and provide a new representation of the adapting reality.

Adaptive mental models. As noted in Chapter I, the researcher designed the study using the social constructivist lens in order to ensure the research questions were developed to understand the meaning the executives may construct from the individual, organizational, and environmental spheres of influence (Merriam et al., 2007; Vygotsky, 1978). The nature of social constructivism emphasizes that all cognitive functions, including learning, are dependent on the interactions of others and are an active process (Vygotsky, 1978). This led the researcher to sense that the executives constructed their mental models through a social constructivist approach and have multiple viewpoints of the world that may bring in social, cultural, and language attributes as influencers. To this

end, the researcher coded the number of times the executives explicitly mentioned they 'changed their viewpoints' (or similar), based on new information to think their way through ambiguous challenges.

The researcher also explored the executives' background and previous personal and professional experiences to understand the influencers, relationships, and elements that may have helped to interpret meaning of the development of their mental models and identify any patterns of thought, experiences, and narratives, and, ultimately, the meaning of how the participants make sense of their world (Creswell, 2007).

Excerpts showcasing explicit narratives in reference to adaptive mental models and action-orientated behaviors. The narrative descriptions indicated adaptive mental models evidence emerged from the narrative data. The following section includes different aspects of the executives' changing thinking patterns, as described by the executives as integral to a systems thinking mental model. The excerpts and description of the interviews continue the journey through the executives' mental models and add insights into a connection to the adult learning theory of adaptive mental models and a systems thinking mental model in three areas: (a) seeks meaning and adopts sense-making attributes, (b) promotes critical dialogue, and (b) fosters crucial connections.

Systems thinking and informal learning strategies enable executives to tackle the uncertain and ambiguous issues that are prevalent within complex adaptive systems by thinking through their own assumptions and beliefs and questioning the structure of the issue to discover new or alternative ways of approaching the situation. Similarly, the term *double loop* learning was coined by Argyris and Schon (1978, 1996) and described this type of learning where long-held assumptions about systems and policies are challenged

by questioning existing processes and procedures and encourages system-wide thinking and continuous evaluation and knowledge development (Curado, 2006; Tsai, Wu, & Chung, 2010).

Due to constant shifts within complex adaptive systems or ‘messes,’ as described by Ackoff (2004), it is essential to have insights that essentially allow one to ‘see around corners’ for understanding the linkages and interactions within the individual, organizational, and environmental spheres. Jackson (2003) described a critical systems approach as the creative holism as the study of wholes rather than as focus on the parts and stated that simple solutions rarely work in the face of significant complexity. Flexible mental models may enable the executives to see all parts of the organization and environment rather than focusing on the issues as they arise, as ALPHA001 stated: “I think a lot. I’ve always been open to challenges and to learning and changing my viewpoint. If presented with new information. I would change my mind.”

One hundred percent of the executives expressed a need to have a fluid and dynamic thinking style that questioned their own assumptions, as MAMA001 stated in another scenario in which all stakeholders agreed to proceed with a new project, but the project was not progressing as planned:

[The agenda was not progressing]...so I need to find out what is missing, and it means that there’s something going on that I don’t know about. I try to reflect back on it and go okay, what is it I haven’t seen.

ROMEO001 provided a description of an experience in which a complex government visa issue caused the executive a huge temporary setback in terms of career progression. Feeling a lack of control of the situation, ROMEO001 reflected on the situation and eventually presented a unique solution to the government that was

approved. During and after the experience, ROMEO001 expressed the need to make a ‘personal shift’ in thinking in order to make meaning of the experience: “I was forced to become humble after [a situation]...definitely a mindset shift was required, and it was very painful.”

Forty-two percent of the executives identified moments of learning within the certain context, such as their upbringing, and reflected on that context in order to create meaning and pointed to clues in their upbringing as key experiences that may have helped to develop a dynamic mental model. This included KILO001 who started the interview by stating:

I was born, schooled and did my undergraduate and part of my graduate studies in Lebanon during the time of the civil war (1975-1990). Growing up in this environment teaches you early on how to make critical decisions with limited information. While I do not wish for anyone to go through such a learning process, it taught me early how to make decisions with limited data, such as ‘is it safe to go to school today?’, ‘how will I access the university campus if the checkpoint is closed?’, ‘how will I access the computer lab if the power is down?’ The constantly changing situation on ground teaches you the value of dynamic thinking. Again, there must be a better way to learn these skills.

MAMA002 spoke explicitly about the UAE context in terms of gaining information to help formulate meaning of the experience. The executives worked with consultants and during the interview, pointed to one of the consultants walking by the office and indicated that both he and the consultant regularly draw on the office walls, which were whiteboards, to discuss various thinking styles and alternative ways to view a problem. MAMA002 also indicated a unique UAE cultural practice of visiting the *majalis*, which is an Arabic term for a gathering place where community members discuss events, socialize and exchange ideas, to gain more insights into large and small

scale shifts that may occur in the region or globally that may impact MAMA002's own thinking style when faced with ambiguity. MAMA002 stated:

Getting information is important and here is the UAE, visiting the *majalis* is how you get information. It might be rumor. It might be truth, but eventually you confirm it [the information]. How I do it and how I control or organize the information is that I tend to go to the organization itself and ask [more questions] to lower the risk of uncertainty.

The following executive excerpts point towards adaptive responses as they unfold for making meaning in a certain community or cultural event (Lave & Wenger, 1991).

MAMA001 detailed a unique work experience in which the executive did not understand why the workers did not respect work attendance rules whereby the workers did not show up to work at certain times. MAMA001 found that the regular business practices of warning letters or disciplinary action were not effective. Knowing that MAMA001 was working with many foreign nationals, MAMA001 needed to understand the culture and customs to higher degree. MAMA001 described the situation:

I couldn't get my arms around a few things [GCC labor situation] with lots of people from Yemen, Oman, India, and Philippines and what I find out is that if twenty percent of the workforce does not show up, it has something to do with a celebration or something. And you know, that's when you get into learning about certain values, systems. And so, I looked at getting advice,...and visit the Sheikh of those tribes.... I found out that there's all these different structures and the way societies are managed.... If you don't want to understand it, you are going to have an issue, so you have to adjust.

ECHO001 also stated in response to understanding international relations:

Well, most things in life are not linear. You just try to see what the other side is trying to achieve. In certain societies, that is a lot easier. If I'm talking to a European, German or Swiss banker, it's very easy. They don't beat around the bush.... If you're having the same conversation in environments like the UAE or Saudi Arabia, Egypt or Iran, what the other person is telling you sometimes has five different meanings. You have to be able to read between the lines. That is the most difficult thing to do.

Diving more deeply into the components of an adaptive mental model, 100% (12 of 12) of the executives' narratives pointed towards describing the same three key aspects of their cognitive learning architecture of adaptive mental models, which included 'action'-orientated behaviors that influence the development of an adaptive mental model: (a) seeks meaning and adopts sense-making attributes, (b) promotes critical dialogue, and (c) fosters crucial connections.

Seeks meaning and adopts sense-making attributes. One of the key elements of a systems thinking mental model identified from the narratives was the premise of taking 'thinking strategies into thinking action.' Thus, being able and willing to understand or at least be curious about the premise of learning from experiences, learn from behaviors (self and others) and find importance of context to query, turn information into knowledge and modify it in some way to promote action or reaction to an event, are important behavioral attributes in a systems thinking mental model. One of the key elements of ambiguity is being able to understand cause-effect relationships with large time delays, and this is difficult in complex adaptive systems due to changing agents and emergent systems behaviors. The executives tried to "structure the unknown" (Waterman, 1990, p. 41) to "comprehend, understand, explain, attribute, extrapolate and predict" (Starbuck & Milliken, 1988, p. 51). One hundred percent of the executives mentioned trying to make meaning of certain events to identify plausible explanations for the surprising event. This was evident with HOTEL001 who stated:

You know, I suppose my opening point is just being really curious and a whole load of questions. I am typically less curious about 'what happened' or 'how it happened' but more about 'why it happened.'

By being curious, the executives displayed a behavior that promotes a continuous learning journey to understand the changing landscape, interconnections, and various relationships creating opportunity for the feedback loops to come in many forms.

CHARLIE002 self-described as an '*information addict*' to seek meaning from patterns of information and stated:

I am an information addict. I always collect all kinds of information and I have like these different piles on my desk and different folders and always learning all kinds of stuff. Just natural curiosity but I never know exactly why I need it.

Similarly, KILO001 was also trying to construct meaning and stated: "The right model for me is to learn about and develop a certain model, adopt and continuously evolve it.

You have to be obsessed with the idea of constant evolution in order to achieve continuous progress."

Complex adaptive systems contain paradoxes, rapid changes, and dynamic forces that cause knowledge to become quickly obsolete. Through the concept of sense making, ROMEO001 stated that by being resilient and linking threads of information, the thinking patterns can become clearer:

[The ambiguous situation] I solved it, myself. A little bit of chance and a little bit of pointing in the right direction and insisting on it. Sometimes when you feel grumpy and upset, maybe that is the fuel that is required to point you in a specific direction to keep you 'resilient.'

Promotes critical dialogue. Complex adaptive systems involve a holistic view of the system that contains fluid and dynamic feedback loops which connect to the changing environment. Not one person can understand the entire system, and embracing diversity of thought, multiple perspectives, and viewpoints is critical for developing a systems thinking mental model. CAS is composed of a "network of many agents gathering information, learning and acting in parallel in an environment produced by the

interactions of these agents” (Dodder & Dare, 2000, p. 2). Leveraging information through critical dialogue seeks to uncover heuristics or rule-of-thumb thinking to create a broader platform of ideas. ALPHA001 explained how meeting with different people to view the same problem provided a better understanding of the root cause issue.

ALPHA001 stated: “They have different skill sets and they complement each other. To have one person calling all the shots would not give a holistic picture.” Moreover,

CHARLIE002 stated:

You can actually discover new territory and create something new. It’s usually not driven by numbers, it’s determined by a group of people trying to aspire something and willing to go on a path of discovery rather than ‘what do we know.’

Promoting critical dialogue encourage systems-wide thinking as attention is placed on information from multiple sources—essentially the relationships and networks between the parts, i.e., departments, rather than solely domain-specific information. Being able to detect and correct errors in organizations is more than following norms or rules, the learning points towards critically questioning the operating norms (Argyris & Schon, 1978). Mintzberg (1994) supported that flexibility of executives’ mental models is to question their deeply held perspectives of the world and stated “every manager has a mental model of the world in which he or she acts based on experience and knowledge” (p. 368). However, it is difficult to question one’s own assumptions in isolation. One hundred percent of the executives provided evidence of critical dialogue as an important factor while describing a significant learning moment, which is more than just placing effort on good communications, but rather placing more emphasis on creating situations that blend interactions for the purpose of sharing information to learn about the issues at hand. CHARLIE002 was emphatic in the explanation that innovation does not work

without critical discussion in which different viewpoints are explored. The executive explained that building a corporate culture that integrates this discussion practice, such as ‘*scrums*,’ is part of the important learning journey:

But you’ve got to rely on people and by doing that, you create a culture of ‘solution-based thinking.’ You create a learning environment that allows those learning moments to occur.

Dewey (1997) stated that critical inquiry is one of the main elements of being able to learn from experience, while the concept of team inquiry-based dialogue is widely used and referenced within organizational learning theory. ALPHA001 stated in context to the work domain activity, the ‘*safety huddle*’ helped create deeper learning by blending a form of communication with purposeful interactions:

Every morning is a safety hub, everybody, all the chief executives, all the managers and quality people, we get in a room “What happened in the last 24 hours? Were there any events?...” Then [anyone] can say what’s on their mind [to share]. This didn’t present itself as best practice until the last five years.

More information can be gleaned through direct interactions, which are a form of extracting tacit knowledge from individuals and converting it to explicit knowledge. Through dialogue and interactions, the executives are challenging routine ways of communicating and increasing potential for uncovering ‘unknown knowledge’ through interactions. KILO001 stated:

I try to reach out to the guys who probably are the most insightful. They are probably not the highest in the hierarchy, but generally, they are the people who would be excited about telling you how things work. Then you start listening and learning about the alternative models.

Extraneous factors force the executives into seeking information; thus, critical dialogue was identified as essential to the executives’ learning architecture through an analysis of the narratives. For example, CHARLIE001 stated:

If we were able to do x, y, z, then perhaps we could achieve this outcome. When you're searching for a solution to a difficult answer, then you need to involve a whole range of different people.

Additionally, CHARLIE002 stated learning about knowledge sharing early in the career was beneficial to learning how to navigate through uncertain situations:

You have the social intelligences, you have the people like me who could recognize patterns and somehow translate and communicate that. You had people who were just brains, they could mathematically do anything. You certainly gain an appreciation for it. Hey, if you put all this together, you could do anything in the world literally, because you covered all the bases. That gave me real insight.

HOTEL001 took on group questioning as the modus operandi to uncover information, perspectives and understanding: "You know, I have spent entire meetings [asking] questions. I try to be 'more in questions' to get perspectives."

Fosters crucial connections. The third relevant 'action-orientated behavior' description elicited from the executive narratives when describing elements for an adaptive mental model was fostering crucial connections. As they described it, the executives placed emphasis on the people within the environment in order to create the crucial connections to enhance the inquiry process. KILO001 explained the ideal plan for any complex or uncertain situation that needed to be addressed and stated:

The objective is to recruit the best minds in the industry. Each of these individuals comes with essential knowledge. When they join communities of interest, they start shaping the capabilities systems that markedly impacts the way we deliver solutions in the market. This system also starts exploring new ways of doing things, triggering constant evolution.

Other executives explored their perspective and their environment through the crucial connections that were required for any situation. CHARLIE002 continued to explain how understanding the team, in all of its diversity, is strongly recommended before a solution can be reached. CHARLIE002 stated:

I'm obviously just trying to get to the other person's perspective. Trying to find the empathy, the anchor points which can help me to create a language with that particular person or group of people. Determining what the cultural inheritance is and where are the mandate, where you are crossing the lines. You have to do the mapping out of the person before you go into how you are going to translate it to complexity. I'm very much into this self-reflective loop. Finding the right work, then doing the work right. The crux of this is really based on connecting with people.

While cognitive reasoning supports flexible thinking change mechanisms, the process enhancement change involves other people, elements, and influencers to correct an error or organizational issue. A wide-angle lens includes building a network of learning relationships that emphasizes a systems thinking mental model. Wenger (1998) described this type of learning as part of the community of practice model for situation learning, in which learning arises from the participation in the wider social network (Lave & Wenger, 1991). For example, ALPHA001 stated, "I like the excitement, the unpredictability, the comradery, the collaboration. This is always a team," while CHARLIE001 stated in context for a large-scale complex issue that needed collaboration from a diverse group to "think through a new way of doing things."

So, you would always get the enthusiasm of youth and the experience of someone who's been around awhile. And they were considered sort of equal, so everyone's opinion had to be listened to, encouraged discussion.

The executives placed considerable value on nurturing the relationships within the network to find uncover disconnects and seek understanding, which is difficult in complex and global entities, but considered integral to developing a systems thinking mental model as MAMA001 stated:

We all have a sort of common language we do in business regardless of whether your friends are Canadian or Dutch or other. Business...there's always forces at play I guess, that we can't see but they have to do with financial experiences or maybe politics...other elements of socioeconomic are not immediately visible.

The executives exhibited the ability to be more aware of how, through their experiential learning lens, to step outside of their potentially dominant ideology or culturally determined perspective to craft new ideas or alternative perspectives (Fenwick, 1999).

DELTA001 stated that an expanded perspective was instilled by becoming involved in a new community of perspectives and stated:

There was a movement [in the early 1970s] which opened my eyes in terms of whether you want to call it radical or not, but it did give me a broader sense. The more I saw, the more I became involved in student government, student protests... it did give me a broader sense.

In this context, building a community featured heavily in the executives' narratives; the executives also indicated that crucial connections within the organization or their network were important for having diversity of thought and problem solving for the positive impact of creative thinking, especially within complex adaptive systems. One hundred percent of the executives' narratives described "building a community" or tapping into the "network" to find value in developing connectivity mechanisms. Complex adaptive systems have self-organizing agents within subsystems and problems are fluid. A necessary condition for overcoming or recovering from disturbances is to develop deep connections throughout the organization to ascertain the next decision.

CHARLIE002 explained how understanding people is more important than understanding the process:

Once you realize the work package is a really pathetic way to help people get things done, you can hop into a different paradigm and say, "Well, let's aspire to do something, what do we have, what do we need?" If you maintain mutual benefit constantly, then things tend to self-organize. If you're conscious about "we are all in this together," you get something and create that value.

KILO001 was equally supportive of building a community to progress a project and stated:

Complex situations are often unlocked thru conversations. Through these fluid exchanges you get a sense of what is important and build on the different viewpoints. Solving problems by trading documented briefings is too static as a process.

By contrast, ROMEO001 stated:

I think with “buy-in” and winning people over, working on your partners’ journey.... That part of your journey is critical.

Analysis of the data. As noted in the purposeful sampling of the executives to identify executives who have worked in the UAE, it is logical to conclude that the majority of the executives selected would be expatriates. In fact, 92% (11 of 12) of the executives were expatriate workers working in the UAE. Additional diversity analysis indicated that 58% (7 of 12) of the executives worked in three different countries, 41% (5 of 12) of the executives worked in four different countries, 66% (8 of 12) of the executives spoke a second language, and 41% of the executives spoke at least three languages. These demographic attributes suggested the executives may have experiences in different cultural situations that may have influenced their world views and adaptive mental models. Even the one executive, who is a UAE National, has global education and international work experiences among a multitude of nationalities, which may have provided a world view that shifted from the executive’s “upbringing” mental model. The finding provided insights into how the executives learned to interact and learn from their social environment through different experiences and spheres of influencers that may have assisted in the development of adaptive mental models.

During the interviews, 66% (8 of 12) of the executives described an issue with an operational problem or a large-scale project that required a 'shift' in thinking in order to meet the expected outcomes in which having a dynamic mental model was required. Additionally, 33% (4 of 12) of the executives described either an emerging marketing issues (8%) (1 of 12), innovation (8%) (1 of 12) or a strategic creation (17%) (2 of 12), as one of the key projects where a mental model shift was self-evident. The transcripts were also analyzed for the number of times the executives explicitly mentioned that a mental model 'shift' took place. The numbers ranged from three to 21, with an average of nine mental models shifts mentioned per executive. While these data had no baseline to indicate if this was a large or small number of executive self-identified mental model shifts, the data did indicate that each executive was aware of his or her own cognitive shifts and how the trajectory of his or her thinking patterns changed based on new or conflicting information.

Summary. In summary of Finding #2, evidence suggested the executives employed adaptive mental models as a key element of their learning and knowledge seeking architecture and placed emphasis on: (a) seeks meaning through experiences and adopts sense-making attributes, (b) promotes critical dialogue, and (c) fosters crucial connections to learn within ambiguous situations.

Finding #3: Types of Experiences: Challenges and Ambiguities

The second research question, *What are the experiences that provide the scaffolding in developing a systems thinking mental model (experiences and events)?*, was explored in the context of seeking information about what role do the executives' experiences and education play in the development of a systems thinking mental model

as well as what types of events or situations impact the executives' learning of a systems thinking mental model. By coding the executives' interviews through the reflective thinking and practice narratives and the learning from experience lens, three broad types of experiences were collated from the narratives. This included events or situations that involved: (a) ambiguous situations, (b) exposure to alternative ways of thinking, and (c) challenging assumptions. The third key research finding of 'types of experiences' was analyzed in three areas: (a) understanding of the finding, (b) excerpts showcasing explicit narratives in reference to adaptive mental models and action-orientated behaviors, and (c) analysis of the data.

Understanding of the finding. The interview questions were posed to elicit insights into the types of experiences the executives described through each of the three research questions; through the analysis of the coding of types of experiences, the researcher was able to identify the executives who used a variety of personal and corporate examples with regard to the type of experiences that may have provided the scaffolding in developing a systems thinking mental model. During the interview, the researcher did not prompt the executive to give a 'work example' or a 'personal example.' However, the first interview question was *'Tell me about your upbringing.'* This question enabled the executive to take the researcher on a journey of the executive's personal and professional journey. The second interview question asked the executives to describe an ambiguous experience and their thinking patterns during the experience. The experience descriptions ranged from over 14 different types of experiences from the three spheres of influence: individual, organizational, and environmental. The executives'

excerpts provided more clarity on the thinking patterns within the different experiences cited during the interview.

Excerpts showcasing explicit narratives in reference to types of experiences.

Further distilling the executives' narratives provided insights into the types of experiences within the individual, organizational, and environmental spheres to determine that the learning experiences were based on the ambiguous or uncertain circumstances or other influences or situations within three consistent types of learning experiences cited: (a) ambiguous situations, (b) exposure to alternative ways of thinking, and (c) challenging assumptions.

Ambiguous situations. The first prevalent type of experience coded from the executive narratives was ambiguous situations. The premise was that the executives elicited valuable learning lessons from being immersed in uncertain situations which may not have occurred in routine situations. For example, CHARLIE002 used the analogy of an unknown forest and stated:

When I get into these ambiguous and conflict situations, that's when I realize I'm in a spot where a value can happen. I feel like I'm trekking in an unknown forest looking for the big waterfall somewhere. I get very curious, I get very focused and you look for handholds in this landscape or whatever metaphors to create my path through it.

While CHARLIE001 stated that employees can untangle complex issues through collaboration, more importantly, CHARLIE001 dispelled the myth that complex situations are not barriers:

Once you involve people in solving really complex issues, which a number of people don't think we'd ever be able to find a solution, it becomes contagious. It becomes a way of life. You know, I can do it and there's no saying no to this [unique] situation.

Although managing the unexpected is prevalent in complex adaptive systems, Weick (1995) explained that sense making was the process of people giving meaning to their experiences. Within ambiguous situations, learning to develop a systems thinking mental model can include a scan of the senses. ALPHA001 explained:

[The unique situation] I am absorbing color, taste, touch and using all my senses to size up [the unique situation] by being in unpredictable situations and seeing all the different things, you do develop intuition based on your experiences.

The rewards of being involved in dynamic and unique systems can contribute to deeper systems thinking learning. MAMA001's narrative mirrored that premise and stated the following about a new project with limited resources in an uncertain environment:

It [the project] was almost impossible to deliver. It was two years of hardships. A lot of stress. Twenty-four/seven working, there was not a social life, but it was really rewarding because I found ways.... I discovered a lot of new ways to find solutions to problems.

Exposure to alternate ways of thinking. One hundred percent of the executive narratives pointed towards having exposure to alternate ways of thinking as influencers on developing a systems thinking mental model. However, in this area, the researcher found more diverse experiences cited. For example, 42% of the identified salient narratives pointed towards team discussion as an important element of gathering an alternative way to think, with 8% (1 of 12) stating specifically that diverse voices on the team are valuable.

Seventeen percent (2 of 12) of the executives cited meeting "thought leaders" or reading business or leadership books as having an influence on developing alternative ways of thinking. This included a narrative from DELTA002:

My life changed when I read *Men Are From Mars and Women From Venus* (laughter). I was a teenager when I read it, but I began to understand, a different language. It helped me decode it [perspectives]. And the book *Thinking Fast and Slow* by Daniel Kahnman and his phrase ‘what you see is all there is.’ That struck me.

Other executives cited mentors (8%) (1 of 12), cultural experiences (17%) (2 of 12), and academic learning (17%) (2 of 12) as important influencers.

Challenging assumptions. The executives provided insights into their experiences that may have led them to develop a systems thinking mental model. For example, 100% (12 of 12) of the executives provided an example of how they learned to challenge their own assumptions or challenged the situation to find good learning moments. Challenging personal, behavioral, or organizational assumptions is seen as part adaptable mental model. ALPHA001 provided a description of a process to challenge assumption:

You see something highly unusual or you’ll see something that deserves attention, deconstruction, root cause analysis or other so you can figure out “why did that happen like that?” Much of the time, what you think caused the problem is not what caused the problem and you don’t know that until you really ask a lot of questions and a lot of digging to find that out.

CHARLIE002 posited that value is created when the status quo is questioned with the following statement:

You are diving into processes and suddenly you become self-involved. You become the process, the governance of your world of perspectives. Therefore, you lose perspective, you lose sight of opportunities. If you don’t reflect that, Hey, am I doing the right work? Not just doing what I’m doing. What I’m doing well. All kinds of that “Are you just going to go low?” All kinds of good experiences, ways of involving people. What we say in business, “value to create” gets lost by the wayside because you are doing what you’re doing right now very well.

Other executives provided excerpts that spoke to their own assumptions being challenged, which provided learning insights. DELTA001 talked about an insightful confrontation: “Probably a bit of the stars aligned, certainly, I think.... I started to realize and that got my attention.” KILO001 stated a thought leader’s business course on “strategic advocacy” was thought-provoking to understand the holistic nature of seeking different perspectives for good business outcomes. As KILO001 stated:

I loved this model of strategic advocacy taught at Columbia University because it opens your eyes as to how other stakeholders are positioned vis-à-vis your advocacy, and what you can do in order to bring them closer to your line of thinking. This was an Aha! learning after 30 years as a professional.

Analysis of the data. Table 16 shows the type of experiences described during the interviews and the frequency of the experiences listed as taken from the most salient executive references for research question #1 in reference to mental models, thinking patterns and reflection. Table 16 illustrates that 68% of the experience references provided the top five types of experiences and 48% of the experience references provided the top three types of experiences and included: (a) perspective taking, (b) upbringing situation, (c) socioeconomic forces, (d) sharing information, and (e) humble leadership moments.

The wide range of experiences cited in the narratives points toward a wide view of the person, organization, and the environment in terms of learning cues to build a systems thinking mental model with 14 different types of learning experiences identified. Ninety-one percent of the experiences were identified as informal learning experiences outside of the formal learning environment, reinforcing the idea that a systems thinking mental model may be learned informally as 13% (8 of 60) of the perception narratives pointed towards an “upbringing situation.”

Table 16

Narratives of Reflection Thinking and Practice: Types of Experiences and Frequency

Type of Experiences	Frequency
Perspective Taking	12
Upbringing Situation	8
Socioeconomic Forces	8
Sharing Knowledge	7
Humble Leadership Moments	6
Puzzling Moments	5
Career Choice	3
Information Seeking	2
Inefficiencies	2
Strategic Dilemma	2
Learning About Behaviors	2
Big Picture Understanding	1
Corporate Community Building	1
Office Politics	1
Frequency	60

In conjunction, Table 17 shows the type of experiences expressed in the salient narratives for the research question, *What are the experiences that provide the scaffolding in developing a systems thinking mental model (experiences and events)?* This indicated a spread of experiences that span within three categories: individual, organizational, and environment spheres of influence. As such, 43% of the first research question responses aligned with internal or individual cognitive learning experiences, which placed emphasis on reflective learning techniques, while 36% of the responses were within the context of organizational learning moments and 21% of the responses were in relation to the

environment, whether it was an upbringing event, paying attention to a big picture, or various socioeconomic forces.

Table 17

Author's Type of Experiences Categories

Types of Experiences	Sphere of Influence	%
Upbringing Situation	Environment	
Socioeconomic Forces	Environment	21%
Big Picture Understanding	Environment	
Perspective Taking	Individual	
Humble Leadership Moments	Individual	
Puzzling Moments	Individual	43%
Career Choice	Individual	
Information Sharing	Individual	
Learning About Behaviors	Individual	
Sharing Knowledge	Organizational	
Inefficiencies	Organizational	
Strategic Dilemma	Organizational	36%
Corporate Community Building	Organizational	
Office Politics	Organizational	
		100%

Summary. In summary of Finding #3, evidence suggested the executives' reflective thinking and practice narratives, through the learning from experience lens, described three types of experiences: (a) ambiguous situations, (b) exposure to alternative ways of thinking, and (c) challenging assumptions.

Finding #4: Ambiguity Thinking Strategies

The third research question, *What aspects of the individual, organizational and environmental interactions enable executives to develop systems thinking capacity to develop?*, was explored with the intent to capture information such as *How do the executives develop their knowledge and decision-making architecture within ambiguous situations?* and *What elements, influencers, and interactions promote better business outcomes?* The difference between the second and third research questions was to discover powerful influencers that may promote the learning on how to develop a systems thinking mental model and the actions that may be required to develop this cognitive capacity. The executives were asked the final interview questions that sought to identify good learning moments of learning to develop a systems thinking mental model and the description of what elements were involved. Lastly, the executives were asked what key learning ‘ambiguity thinking strategies’ they felt were important to developing a systems thinking mental model.

Understanding of the finding. As noted by Pietersen (2000), “learning gives us half of the adaptation equation. To complete it, we must explicitly link learning to the creation and implementation of a winning strategy” (p. 39). Thus, in this context, the research study suggested the development of a systems thinking mental model is to improve our understanding of ways in which to respond to operational uncertainties and seek to leverage one’s own thinking patterns to address those challenges. The data provided a link between a systems thinking mental model and ambiguity thinking strategies in which a systems thinking mental model is part of a cognitive thinking and action-orientated behaviors that encompassed a comprehensive range of knowledge,

abilities, and conditions that enable a dynamic and adaptable mental model to address the fluid and changing conditions that may be apparent in complex adaptive systems. The term *ambiguity thinking strategies* provided an organizational operational perspective on how cognitive learning practices may provide context and understanding on how executives can align inexactness, paradoxes, or uncertain situations (ambiguity) within the business context (principles and practice) and the ideal conditions (influencers, elements, interactions, and knowledge-making architecture) to create an ideal learning pathway to assist in the development of a systems thinking mental model. This premise aligned with Pietersen's (2000) strategic learning definition, which is the "deliberate and practical process for generating insight, making choices and acting on them and then adapting successfully as the environment changes" (p. 827).

The articulation of the executive's description of ambiguity thinking strategies and the elements and influencers that create the ideal learning pathway to develop a systems thinking mental model was captured through the three research questions and detailed the type of experiences, adaptable mental models, action-orientated behaviors, and reflective thinking and practices utilized. The data for Finding #4 pulled heavily from Finding #1-#3 and the focus group session outcome to understand if the collated data did, in fact, support the executives' final ambiguity thinking strategies outcome. As noted by Mintzberg (1994), strategy thinking is the "synthesis and involves intuition, creativity and the outcomes of strategic thinking is an integrated perspective" (p. 108). In this context, Mintzberg was making the point that strategy making requires informal learning that produces new perspectives and new combinations of thinking patterns.

Finding #4 collated the executives' narratives and sought to understand the context of the ambiguous situations and any operational strategies to enable learning of how to develop a systems thinking mental model. The executives' final comments were centered on five themes, coded from the narratives, that comprised their ambiguity thinking strategies: (a) be curious; (b) build a community/networks; (c) develop comfort in the unknown; (d) ensure diversity of thought; and (e) seek to understand the person, context, and environment.

The executives' final narratives took on a cumulative type summary that brought in the elements of the previous interview questions and allowed the executives to ponder their final thoughts on any succinct learning moments, elements, or key lessons that may have been important to highlight. The researcher collated the five themes and aligned the themes with the previous Findings #1-#3 to seek an understanding of how these concepts aligned (see Figure 11).

Systems Thinking Mental Model Research Findings		
MENTAL MODELS	LEARNING & KNOWLEDGE SEEKING ARCHITECTURE	LEARNING FROM EXPERIENCE
Social Constructivist Lens	Informal Learning • Seeks Meaning from Experiences	Ambiguous Situations
Reflective Thinking & Practices	Adaptive Mental Models • Promotes Critical Dialogue • Fosters Crucial Connections	Exposure to Alternative Ways of Thinking Challenging Assumptions

Executives' Ambiguity Thinking Strategies

1. Be Curious
2. Build a Community/Networks
3. Develop Comfort in the Unknown
4. Ensure diversity of Thought
5. Seek to Understand Person, Context and Environment

Figure 11. Author's systems thinking mental model research findings

In response to the interview question "What are the key ambiguity thinking strategies for future leaders?" a total of 27 responses was provided that ranged from one response from 33% (4 of 12) to five different responses from 8% (1 of 12) executives,

with an average of two responses per executive. Table 18 shows the statements aligned with the ambiguity thinking strategy themes and Findings #1-#3.

Table 18

Author's Ambiguity Thinking Strategy Themes

Ambiguity Thinking Strategy Themes	Executive Key Lesson Narrative	Aligned with Findings #1-#3 Components
Be curious	<ul style="list-style-type: none"> • Explore and expand learning throughout the world • Treat everything as a discovery process • Understand where the pressures are coming from • Be curious about changing situations and why • Be open to differences 	<ul style="list-style-type: none"> • Adaptive mental models • Seeks meaning from experiences and adopts sense making attributes • Promotes critical dialogue
Build a community/networks	<ul style="list-style-type: none"> • Create a trusted network • Build a comprehensive team • Build a community 	<ul style="list-style-type: none"> • Foster crucial connections
Develop comfort in the unknown	<ul style="list-style-type: none"> • Build confidence for new situations • Adapt to situation • Connect the dots forward • Be resilient • Chaos is part of everyday 	<ul style="list-style-type: none"> • Ambiguous situations
Ensure diversity of thought	<ul style="list-style-type: none"> • Understand stakeholders' perspectives • Be humble enough to change style when needed • Bring diversity to the table • Seek diversity of thought • Prepare team to see different points of view • Ensure team diversity and different capabilities • Be compassionate to difference 	<ul style="list-style-type: none"> • Exposure to alternative ways of thinking
Seek to understand person, context and environment	<ul style="list-style-type: none"> • Understand your environment • Understand your cultural situation • Help employees respectfully and mindfully within the situation • Respect for others • Learn about context of the situation – the history • Conduct self-reflection to seek clarity • Be able to seek information beyond what you see 	<ul style="list-style-type: none"> • Social constructivist lens • Reflective thinking & practices

Furthermore, the focus group exercise was to construct a systems thinking causal map for an ambiguous or uncertain corporate issue, which helped to highlight the ‘visible thinking patterns’ and understand the elements, influencers, or key variables the focus group executives identified as part of a systems thinking mental model. In essence, the focus group was an additional data collection method; however, within the focus group design, there were also three sub-collection data areas: (a) the systems thinking causal maps, (b) the responses to the five group questions, and (c) the open discussion. Finding #4 was formulated through data triangulation.

Focus Group—Data Triangulation

The six focus group participants’ causal map exercise provided data insight into Finding #4. A causal map can provide a pictorial of the participants’ mental model as it shows explicitly the participants’ understanding of the problem and their thinking process as the layers of systems thinking elements are introduced. The exercise included identifying: (a) the interrelationships, (b) the negative and positive feedback loops, (c) the unknown or ambiguous elements, and (d) the cause-effect situations. The focus group executives chose a complex or ambiguous problem, with 100% (6 of 6) of the illustrations indicating non-linear relationships. Sixteen percent (1 of 6) chose a problematic issue such as a software implementation process, 32% (2 of 6) illustrated a large-scale corporate initiative, and 50% (3 of 6) outlined a new business structure/model. Within each causal map, there was an average of 10 elements (nodes) to each scenario, 15 identified non-linear interactions and relationships between the elements, and an average of five identified positive and negative feedback loops linked to cause-and-effect variables.

The focus group executives responded to the five questions that mirrored the executives' interview questions, which were: (a) How do you try to understand ambiguity within the workplace? What are your learning ambiguity actions? (b) What are your perceptions/beliefs of the unexpected changes/errors that occur (cause-effect situations)? (c) When you are faced with a puzzling pattern of events, what experiences or significant learning moments helped you to understand or anticipate the next step? What were you paying attention to? (d) When you have good ambiguity/complex learning moments, what elements, people, or influencers are present? What is going on? and (e) If you were to guide future leaders through ambiguous situations, what thinking strategies should they use?

Key Insights

For the question *How do you try to understand ambiguity?*, 100% (6 of 6) of the focus group participants stated that getting clarity to understand the different perspectives was important and included statements such as the one from SIERRA002-FG who explained: "try to understand the true motivation of decision makers" and from GOLF001-FG: "understand the people and their drivers," while ALPHA001-FG reviewed the current state to be able to address the issue before moving into the future state. Other responses were 66% (4 of 6) who stated communication was important, 32% (2 of 6) who tried to collect information (in a variety of forms), and 32% (2 of 6) who stated reflection was a way to try to understand ambiguity, as JULIET001-FG stated: "I try to clear my mind and fill in the blanks."

The focus group executives answered the next question, *What are your perceptions/beliefs of the unexpected changes (cause-effect)?*, with 83% (5 of 6) of the

group answering with operational structure issues (unqualified decision makers, need clear roles and responsibilities, and lack of time), while 66% (4 of 6) added that lack of understanding others' behavior can lead to errors, and 32% (2 of 6) stated that underestimating the level and elements of the complexity are variables of unexpected changes.

The focus group executives answered the third question, *When you are faced with a puzzling pattern of events, what significant learning moments helped you to understand?* These responses included 50% (3 of 6) who stated that previous complex experiences were helpful, 50% (3 of 6) who thought that cultural experiences were important, 32% (2 of 6) who cited their MBA experiences as insights—specifically how teams with equally smart people can function totally differently, and 50% (3 of 6) who stated that they consult mentors or trusted/knowledgeable friends to gain a better understanding of uncertain events.

The fourth question was *When you have a good ambiguity learning moment, what elements, people, or influencers are present?*, with 83% (5 of 6) of the group stating that having a colleague with forward-thinking mindsets was beneficial, 32% (2 of 6) stating that they had access to contextual information to gain more understanding, and 16% (1 of 6) stating intuition was important, as GOLF001-FG noted: “you need to be able to sense change.”

The final question was *If you were to guide future leaders through ambiguous situations, what thinking strategies would you use?* Fifty percent of the focus group executives stated that they would need to understand the true nature of the projects and would try to seek agenda alignment before the project began, 32% (2 of 6) stated they

would implement strong information mechanisms to have every question answered, 32% (2 of 6) stated that multiple thinking styles were important to see the different elements of the ambiguity that might not be apparent, and 16% (1 of 6) stated that building a network was important.

The focus group elicited similar responses to the interview executives; however, it was evident there was less focus on mental model discussion and more on the operational side of ambiguous situations due to the causal map exercise. For example, during the executive interviews, at least 30 minutes was spent discussing mental models, thinking patterns, biases, and assumptions, while the 30-minute causal map exercise provided the illustrated version of their thinking patterns.

The researcher was pleased with the interview and focus group responses as the findings were similar and, specifically, the focus group offered more operational strategies that may be useful for understanding ambiguity in the workplace. Figure 12 showcases one of the six focus group participants' systems thinking causal maps that shows the elements, interactions, dependencies, and positive and negative feedback loops that occurred. Appendix L includes the remaining images.

Summary of Findings

Chapter V provided context of the executives' mental models through the executives' narratives in which the executives provided narrative evidence for four findings. The research findings were collected from the three data collection methods and aligned with various methods of analysis using the perceptual, conceptual, and descriptive frameworks. The four findings were also aligned with a secondary literature

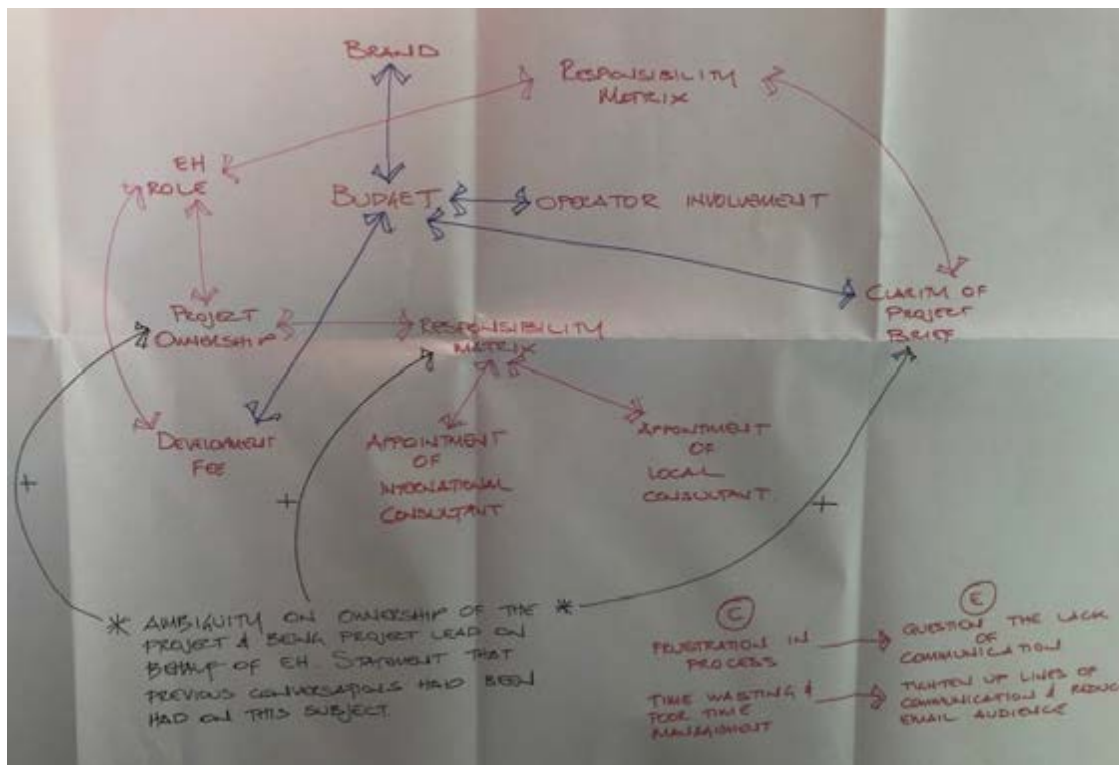


Figure 12. Focus group participant's systems thinking causal map

review and a peer coding review, and were comprised of information from a further scan of the adult learning literature. In summary, the four research findings included:

Finding #1: Each of the executives exhibited reflection thinking and practices as part of their mental model (beliefs, perceptions, and principles) that assisted the executives through unfamiliar challenges.

Finding #2: The executives employed adaptable mental models with key action-orientated behaviors as part of their learning and knowledge-seeking architecture within ambiguous situations.

Finding: #3: All executives in the study indicated three similar types of experiences involving challenges, behaviors, and dilemmas that provided

critical learning moments, within various degrees, within the internal and external work environment as integral to learning how to develop a systems thinking mental models. This included: (a) ambiguous situations, (b) exposure to alternative ways of thinking, and (c) challenging assumptions.

Finding #4: The executives in the study summarized five ambiguity thinking strategies to learn how to develop a systems thinking mental model: (a) be curious; (b) build a community/networks; (c) develop comfort in the unknown; (d) ensure diversity of thought; and (e) seek to understand person, context, and environment.

The next chapter provides the analysis, synthesis, and interpretations of the research findings. This entails an analysis of the similarities and differences among the executives' narratives and an interpretation of the findings from different viewpoints to verify if there were any probably consistent elements that influenced the development of a systems thinking mental model.

Chapter VI

ANALYSIS, SYNTHESIS, AND INTERPRETATIONS

Introduction and Overview

This study used a qualitative and social constructivist paradigm approach in order to explore the meaning of the participants' experiences and to understand their narratives and insights into how they perceived they learned how to develop a systems thinking mental model. The research methodology used three main data collection methods: semi-structured interviews, focus group insights, and a demographic questionnaire.

This exploratory research study incorporates system thinking elements into this chapter and frames the analysis with a holistic view of the data collection sources to understand each finding's meaning and identify the interdependencies and relationships that occurred across all four research findings. The analysis describes the similarities and differences among the participants' narratives and interprets the findings that uncover probable elements that influenced the development of a systems thinking mental model. The analysis also includes literature references that support the exploratory research findings and presents the analysis, synthesis, and interpretations of the study's key findings as they align with the exploratory study's three research questions:

Research Question 1: What characterizes the mental models the executives hold?
(the distinct nature or features of their beliefs, behaviors, and principles)

- A. How do the executives' beliefs of ambiguity influence the development of a systems thinking mental model?
- B. What thinking strategies do the executives employ to make sense of ambiguous or uncertain situations?

Research Question 2: What are the experiences that provide the scaffolding in developing a systems thinking mental model? (experiences and events)

- A. What role does the executives' experiences and education play in the development of a systems thinking mental model?
- B. What type of events or situation impacted the executives' learning of a systems thinking mental model?

Research Question #3: What aspects of the individual, organizational, and environmental interactions enable individuals to learn to develop systems thinking capacity? (relationships, systems, and elements)

- A. How do the executives develop their knowledge and decision-making architecture within ambiguous situations?
- B. What elements, influencers, and interactions promote better business outcomes?

Essentially, this chapter analyzes, interprets, and synthesizes the findings through the following categories in which the researcher understood the findings to be patterned, connected, and interrelated through the following three analytic categories: (a) executives' mental models adapt to ambiguous and uncertain situations (research questions #1 and #3); (b) certain behaviors are an important part of this cognitive

intellectual activity (research questions #1 and #3); and (c) informal learning spans individual, organizational, and environmental spheres of influence and provides systems thinking learning cues (research questions #2 and #3). As noted, the analytic categories are also interrelated with one or more of the research study questions and each analytical category includes collated data from the executives' narratives, focus group, demographic questionnaire, and adult learning literature.

Noting there is a natural urge to narrow the research to one learning model in order to pinpoint how to replicate a systems thinking mental model in the workplace, the researcher was mindful of the exploratory nature of the research and the compelling data, in which the key findings evidence suggested the executives may be subscribing to multiple learning lenses to develop a systems thinking mental model. Thus, each of the three analytical categories explored various theoretical frameworks that may be applicable for positioning the researcher's key findings into a cohesive understanding. Through the executives' narratives during the interviews, the researcher was assured the intent of the responses was aligned with the intent of the research questions as consistent codes emerged from the coding schemes. Additionally, the executives were able to articulate their thinking strategies, experiences, perceptions, and the environmental elements and influencers that may have assisted in the development of a systems thinking mental model.

Three Analytical Categories

Three analytical categories are presented which synthesize the key findings and trends and patterns that emerged from the semi-structured interview narratives, the focus

group session, and the demographic questionnaire analysis. The three analytic categories are: (a) executives' mental models adapt to ambiguous and uncertain situations, (b) certain organizational behaviors are an important part of the cognitive activity, and (c) informal learning spans the individual, organizational, and environmental spheres of influence.

The first analytical category addresses the executive cognitive capacity to manage new, unique, or conflicting information in order to manage uncertain or ambiguous challenges. Systems thinking frameworks at large posit the need to address the interconnected and interrelated elements and changing systems behaviors, while only a sliver of the literature points towards *how* to address the complexity of situation. The conceptual framework introduced in Chapter I included the collated criteria from the four areas: systems thinking, mental models, relevant learning from experience, and organizational learning theories. To address the key findings, the conceptual framework was revised and included the key finding concepts that were missing from the original conceptual framework. This included the concept of: (a) reflective thinking and practices, (b) seeking meaning through experiences, (c) promoting critical dialogue, (d) fostering crucial connections, and (e) challenging assumptions and adaptive mental models. Figure 13 represents the revised systems thinking mental model conceptual framework.

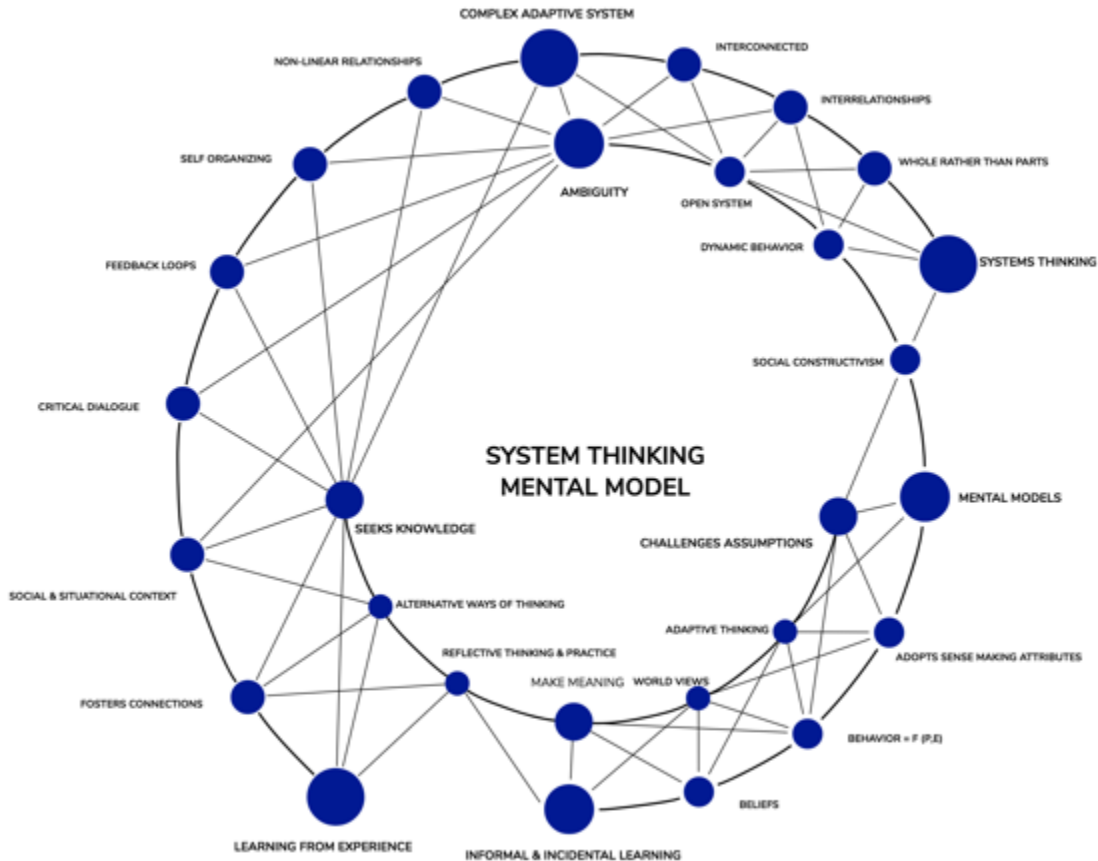


Figure 13. Author's revised systems thinking mental model/conceptual framework

Analytical Category #1: Executives' Mental Models Adapt to Ambiguous and Uncertain Situations

The analysis of Finding #1: Reflective Thinking and Practices and Finding #2: Learning Architecture: Adaptive Mental Models with Action-Orientated Behaviors indicated the executives displayed a social constructivist viewpoint and reflection mechanisms as the foundation of their systems thinking mental model. The executives were explicitly aware of how they used and adapted their cognitive viewpoints through various learning lenses and sought cues from the individual, organizational, and

environmental spheres of influence. To that point, reconciling the premise of how mental models are developed is beneficial.

Mental models are the constructs of one's experiences, assumptions, and views in which we frame our world (Green, 1996). Mental models can frequently become entrenched in a narrow thinking pathway or limit creative thinking options. However, the executives in this research study utilized social and cultural interactions and other experiences to develop ways of perceiving, creating meaning, and understanding the context of their situation in order to make good decisions.

The narrative evidence supported the link between 'thinking and learning' from different experiences and influencers, rather than solely a cognitive reflection process. This also aligned with Lave and Wenger's (1991) statements that "learning is rooted in the situation in which the person participates and not in the head of that person as the intellectual concepts produced by reflection" (p. 61). The data suggested a flexible cognitive process may be at play, whereby the executives adapt their mental models to the context and are continually constructing knowledge through each experience or situation to promote better thinking strategies.

To support the premise the executives' adapting mental models may be based on various social, cultural, relational, and reflective attributes, the interview demographic analysis indicated at least 75% (9 of 12) of the executives had an upbringing in at least two different countries with a variety of cultural influences such as different languages, traditions, and socioeconomic factors. Twenty-five percent (3 of 12) of the executives explicitly described confusing and unique upbringing situations that provided early learning cues of how to cope and understand future unique situations. The socio-

cognitive influencers may help explain why the executives were able to navigate within complex adaptive systems (Weick & Quinn, 1999).

It is also noted that 75% of the executives had one master's degree, 8% had at least two master's degrees, and 25% of the executives had a doctorate degree. This would imply the executives were frequently exposed to new and complex learning scenarios, thought leaders, and alternative viewpoints. It would be important to note that only 8% (1 of 12) of the executives had heard of the term *systems thinking* prior to the interview and only 8% (1 of 12) of the executives who was three-fourths of the way into the interview discussion asked a rhetorical question: "Is this what systems thinking is?" This data point was taken from the researcher's interview notes in which the researcher identified 91% (11 of 12) of the executives as being comfortable conducting an interview on a new topic, thus indicating their ability to move into ambiguous situations or topics with ease.

Laureiro-Martinez, Brusoni, and Zollo (2014) described this ability as "cognitive flexibility" which is fundamental for effective decision making and an important determinant of the organization's ability to learn and adapt to environmental changes. The executives' flexible or adaptable mental models ultimately enabled the executives to accept that there are multiple perspectives or possible framings of any given situation (Johnson, 1993; Werhane, 1999), indicating the executives are the architects of their own version of the truth, influenced by their background, culture, or worldviews (Glaserfeld, 1989).

Key insights. The significance in all the data presented points towards a reflective learning focus, and adaptive mental models are key components of a systems thinking

mental model. The study showed that the executives utilized reflective thinking and practices that reinforced or contributed to their adaptive mental models. The executives could be engaging in Boud, Keogh, and Walker's (1985) three stages of reflection: (a) returning to and replaying the experience, (b) attending to the feelings that the experience provoked, and (c) reevaluating the experience. In this regard, the executives used descriptions of previous experiences to describe their current uncertain or ambiguous experiences. This suggests the executives may have been engaged in at least two of the three stages of reflection: (a) returning to and replaying the experiences, and (b) reevaluating the experience. Only a few of the executives spoke about their feelings in a broader context of the interview. The few references mentioned by 33% (4 of 12) of the executives were feelings of '*frustration*' with certain troublesome issues and '*humbleness*' mentioned when the executives spoke of about '*mind shifts*' and their own admission of when their current view created a cognitive road block. The absence of explicit narratives regarding the executives' feeling should not be overlooked as the researcher did notice the executives were very comfortable speaking about shifting viewpoints, even when describing tension-filled experiences and, at times, even a few executives smiled and talked about their tense moments with excitement in their voice.

The executives may also be subscribing to Kolb's experiential learning model in which four kinds of abilities are required: (a) an openness and willingness to involve oneself in new experiences (concrete experiences); (b) observational and reflective skills, so these new experiences can be viewed from a variety of perspectives (reflective observations); (c) analytical abilities, so integrative ideas and concepts can be created from their observations (abstract conceptualizations); and (d) decision making and

problem-solving skills, so these new ideas and concepts can be used in actual practice (active experimentation) (Merriam et al., 2007, p. 164).

This may be relevant for 100% (12 of 12) of the executives who conducted reflective thinking and practices that may align with Kolb's experience learning model for the following two reasons: the executives provided evidence of: (a) a broad and comprehensive reflective framework that may be required for understanding the types of cognitive perspectives that can be used when confronted with ambiguous and uncertain situations, and (b) the executives' narratives provided indicating 'adaptive' mental models to solve messy or uncertain situations, rather than only using cognitive processing. As per Chapter V, the Findings indicated the executives were action-orientated and "open and willing to involve oneself in new experiences" (Merriam et al., 2007, p. 164). As noted, the executives worked in complex adaptive systems for 10+ years and provided narratives they were continually learning to adapt to situations due to the fluid nature of the systems, variables, and behaviors that acted upon the system.

The second ability of Kolb's model "reflection observations" suggests the executives were able to conduct reflection from a variety of viewpoints. This aligned with Finding #1 in which the executives displayed evidence of using a social constructivist learning lens. During the interviews, the researcher found each of the executives open to discussing their thinking strategies to '*see around corners*' and each description contained elements from past experiences to build on the current experience. The third and fourth abilities from Kolb's model, "*abstract conceptualization*" and "*active experimentation*," may also be evident from the executives' narratives. However, the researcher found the executives were not constructing their viewpoints in isolation;

rather, the executives provided evidence they were using their resources, team, community, and elements of their knowledge architecture to generate new understanding of the phenomena and a change in the systems (Schon, 1983). To this point, the researcher felt the executives were seeking other people's viewpoints or potentially insights into the people's view of the experiences to create a notion of a generalized understanding of the ambiguous situations. These action-orientated behaviors aligned with the works of Schon and Argyris (1974) for 'thinking and action' in a seamless thinking pattern, in which the executives felt comfortable as they described how fostering connections and promoting critical dialogue were important factors to a systems thinking mental model.

Alternatively, when KILO001 described a large-scale technological barrier that eventually changed the way the product was designed, KILO001 may have been using a learning lens that aligned with Dewey's (1933) five reflective phases which included: (a) suggestions, in which the mind leaps forward to possible solution; (b) an intellectualization of the difficulty or perplexity that has been felt (or directly experiences into a problem; (c) the use of one suggestion after another as a leading idea; (d) the mental elaboration of the idea or reasoning in the sense in which reasoning is part, not the whole, of inference; and (e) testing the hypothesis by over imaginative action (pp. 199-209). During the interview, KILO001 drew a model, similar to the one that KILO001 drew during the actual experience with the board members, which illustrated how KILO001 was building on the initial concept and learned from past models to create a better and vastly more effective mental model.

This analytical category posits the executives' mental models adapt to ambiguous and uncertain situations based on their ability to reflect on, seek knowledge, and examine the context to create meaning and learn from that meaning of the experience. The significance of this analytical category suggests that cognitive ability, reflective mechanisms, and a social constructivist view are relevant when faced with ambiguity or uncertainty because adaptable mental models "allow one to experience surprise, puzzlement or confusion" (Schon, 1983, p. 68); evidence supports that the executives were able to move through the thinking, action, and learning cycle.

Analytical Category #2: Certain Behaviors Are an Important Part of a Systems Thinking Mental Model

The second analytic category is based on the executives' cognition with specific behaviors as important components of the cognitive activity. The executives displayed a high degree of 'will' to learn and adapt to the uncertain situations. The research study did seek to uncover any specific behavioral patterns among the 12 executives, and it became apparent from the narratives that the executives embodied their ambiguity thinking strategies with 'action.' Thus, three main consistent behavioral traits evolved from the excerpts as the executives: (a) sought meaning from the experiences; (b) directed the dynamic and critical communication mechanisms within the system to capture information and knowledge; and (c) built connectivity links among the stakeholders within the systems, suggesting a complexity leadership trait of turning their thinking strategies into action by using dialogue and building their network to promote an action that may be part of a systems thinking mental model.

Complex adaptive systems contain non-linear agents that connect to parts of the entire system and are continually influenced by internal and external elements. This also includes the behaviors of the people within the complex adaptive system, who are changing their behaviors to adapt to the system. Weick (1995) suggested the “sense making beliefs are intertwined with actions and behavioral commitment and manipulation are two action driven processes to sense making” (p. 38). Weick explained that commitment is the act in search of the explanation, while manipulation sees problems like a constructivist of the environment. Additionally, Weick described the action “as poking around, or orchestrate some kind of agreement as an action on the world” (p. 163).

The ‘complexity leadership theory’ offers leadership behavioral insights into complex adaptive systems and posits that “relationships are no longer hierarchical but rather interactions and contain heterogeneous agents and work across agent networks” (Lichtenstein et al., 2006, p. 2). Further, adaptive leadership is when the “interactions between the agents leads to an adaptive change” (p. 3). Additionally, Drath (2001) supported the ‘thinking and behavior action’ analysis and stated:

People construct reality through their interactions within worldviews.... [They do it] when they explain things to one another, tell each other stories, create models and theories...and in general when they interact through thought, work and action. (p. 11)

The research study elicited responses in terms of the beliefs, behaviors, and perceptions of the executives about how they developed a systems thinking mental model with evidence indicating a behavior or gaining “system-wide emergent learning” and influencing agents (other employees) to adapt to the change (Lichtenstein et al., 2006). This suggests the executives may be the ‘nodes,’ the emergent elements, the driver of the

interactions that propel the systems change. Thus, the researcher suggests there was evidence the executives have consistent behaviors that may be relevant as part of the learning process to developing a systems thinking mental model as well as the output action: (a) seeking meaning from experiences and adopting sense-making attributes, (b) promoting critical dialogue, and (c) fostering crucial connections.

The analytical category describes how the executives are using their cognitive intellect and behaviors outside the individual sphere of influence to branch into the organizational and environmental areas that may ignite organizational change events. Thus, the organizational behaviors that adopt interactive relationships are seen as a driver for a systems thinking behavior learning lens as the agents (executives) learn to adapt through dynamic interactions based on the context of the situation.

As proposed by Lewin (1936), if behavior is a function of the interaction of the person and the environment, the executives were at the forefront of having to adapt their behavior on a continual basis due to the complex adaptive systems elements which contained changing behaviors and environments. The proposed may be relevant to how executives navigated in CAS and built their adaptive mental models.

The demographic questionnaire analysis supported this analysis and indicated that 100% (12 of 12) of the executives have worked in complex adaptive systems for more than 10 years (as per the target audience protocols). The analysis also indicated that 33% (4 of 12) of the executives have worked between 16-20 years, an additional 33% (4 of 12) have worked in CAS between 21-25 years, and 25% (3 of 12) of the executives have worked in CAS for 31+ years. This longevity may suggest that the executives have consistent behaviors that may be successful leadership drivers for operating within

complex adaptive systems. Further, the focus group identified collaboration and critical dialogue as themes but used a different vocabulary such as “face-to-face discussions, ask obvious questions, and seek context,” with 66% (4 of 6) of the focus group stating: “communication with others”; 100% (6 of 6) identifying “get clarity to understand different perspectives”; and 32% (2 of 6) stating “collecting information” as important attributes to understanding ambiguity.

Behavioral psychology may be important to explore further when cognition, motivation, and personality intersect to help understand the individual, social, and environmental variables that impact complex decision making. For example, the concept of “*learning agility*” was defined by Lombardo and Eichinger (2000) as the “willingness and ability to learn new competencies in order to perform under first-time, tough or different conditions” (p. 323). The elements of the learning agility concept are cognitive and behavioral factors that seek pattern recognition abilities, counterfactual thinking tendencies, and feedback-seeking behaviors (Finkelstein, Costanza, & Goodwin, 2017). Mitchinson and Morris (2014) described learning agility as a “mind set and corresponding collection of practices that allow leaders to continually develop, grow and utilize new strategies that will equip them for the increasingly complex problems they face in the organization” (p. 3). Seeking to understand the behaviors that enabled executives to change outdated perspectives and learn how to: (a) seek meaning from experiences and adopt sense-making attributes, (b) promote critical dialogue, and (c) foster crucial connections, may enrich organizations decision-making capabilities.

Analytical Category #3: Informal Learning Spans Across Individual, Organizational, and Environmental Spheres of Influence

The third analytic category is linked to informal learning, in which the executives were able to construct meaning from their experiences from all three spheres of influence—individual, organizational, and environmental—to make decisions in ambiguous and uncertain situations. The 12 executives hailed from 11 different domains and seven different nationalities; this diverse group of executives provided key learning moments from all three spheres of influence as well as different social, cultural, and socioeconomic ambiguous situations.

One might argue there is compelling evidence to suggest the executives were able to learn about systems thinking through academic situations, as the demographic questionnaire indicated that 75% (9 of 12) of the executives have one master's degree, and 58% (8 of 12) conducted the master's degree in science or economic-based faculties, such as economics, information management and systems, nursing, and industrial engineering, where systems or complexity theory may have been part of the curriculum. However, the executives provided only a few academic references in the interviews and the few narratives referred to their academic learning experiences in the context of their interactions and events within the university rather than any specific curriculum-based learning moments.

As per Finding #3, the majority of the executives' excerpts involved learning from situations, social and the changing environment. Given the context of the executives' narratives, it appeared that informal learning occurred within the non-routine conditions or when critical reflection was utilized to clarify a situation (Garrick, 1998; Marsick & Watkins, 1990). This was seen from the plethora of executive excerpts in

which the executives described their experiences of learning through unique and complex situations that were part of their everyday encounters working within complex adaptive systems or even before their professional careers were established. The data indicated that learning and seeking from the experiences were part of their learning journey.

KILO001, CHARLIE002, and ROMEO001 described poignant upbringing events in various distressing or unique situations that enabled the executives to learn early in life that their points of reference or cognitive navigation required a conscious understanding of the situation and context to be included in their cognitive framework to better understand future situations.

It would be difficult to determine if the executives were conducting ‘deliberate learning,’ described by Eraut (2004) as a “learning goal is established, planning and problem solving takes place and learning is the expected outcome” or reactive learning in which there was “little time to think or reflect” (p. 237). However, the researcher suggests the executives created their own informal learning conditions for informal learning to take place. This was described by Ellinger (2005), who blended incidental learning with the informal learning process by stating the leaders may have created informal learning opportunities by placing value on knowledge sharing, providing and seeking feedback, experimenting, and environmental scanning (Lohman, 2005). The data indicated the executives used a more intentional motivation to learn about the social environment (Marsick, Volpe, & Watkins, 1999).

This was manifested in the executives’ narratives and their approach to understanding ambiguity and uncertain situations. Their previous experiences had provided them with knowledge and confidence that suspending judgment, seeking

perspectives, and taking the time to pause, reflect, and think through the next potential step with collaborative discussions and critical dialogue would facilitate a positive result.

Their influencing factors may be attributed to learning to seek cues in the individual, organizational, and environmental spheres of influence to a higher degree. For example, the data indicated that executives integrated minor references to their experience descriptions that blended insights from the three spheres of influence. For example, CHARLIE002 discussed minor but important variables such as an individual's knowledge bank, capacity to want to learn to grow the business, and the broader socioeconomic factors that impact the business model. Additionally, ROMEO001 explained how the different personalities and diversity of the team enhanced the strategic outputs from the individual personalities, provided insights that helped build organizational capacity, and were influenced by economic factors. Further, MAMA001 described the social, cultural, and community practices as strong influencers to the company's success. The data indicated elements of informal learning components when discussing how the executives may have learned to navigate through ambiguity, social context, and complexity. This indicated that the executives' learned experiences were highly contextual (Cseh, Watkins, & Marsick, 1999, Ellinger & Cseh, 2007; Eraut, 2004).

Recent research has proposed a "rethinking of informal and incidental learning is required in terms of complexity and social context" (Marsick et al., 2016, p. 27). Looking through the Cynefin framework, Marsick et al. (2016) proposed the term *incidental learning* rather than informal learning in the 'complex' and 'chaotic' domains of the Cynefin framework, suggesting that the unpredictable, emergence, and surprise are factors that support spontaneous incidental learning. While the researcher did not

delineate the nuances between informal or incidental learning per se, both concepts are applicable to learning how to develop a systems thinking model because both concepts focus on ‘reflections and social interactions’ as providing the key points in learning.

Drawing from the situation learning theory, Lave and Wenger (1991) indicated learning is gained from social situations and interactions, while other theories such as organizational learning principles also adopt widespread learning opportunities from informal learning situations from how people interact, promote dialogue, or share information for increased knowledge. While Senge’s (1994) five disciplines seek to enrich organizational learning from the five aspects—(a) personal mastery, (b) mental models (overturning deep beliefs), (c) team learning or collaborating to develop shared knowledge, (d) shared vision, and (e) systems thinking or coming to view one’s own actions—are seen as fundamental to the interconnectivity of others (Fenwick, 2001).

The third analytic category captures the nuanced learning pathways that “emanate from social learning” in the form of informal learning from different domains (Marsick et al., 2016). The executives’ informal learning perspectives align with the ‘rethinking informal and incidental learning in terms of complexity and the social context’; where Marsick and Watkins (1990) originally argued that informal learning is in control of the learner (p. 12), the revised model for informal and incidental learning considers that learning is from events or situations that are “socially triggered, planned and enacted and meanings are collectively shared and shaped” (Marsick et al., 2016, p. 2). The data and analysis of the executives’ interviews, the focus group session, and the demographic questionnaire supported the analytic category that the executives’ informal learning spans across the individual, organizational, and environmental spheres of influence.

Summary

In this chapter, three analytical categories were presented as key areas that provide deeper insights into an analysis of how executives may have learned to develop a systems thinking mental model. The following three analytical categories were identified as: (a) executives' mental models adapt to ambiguity and uncertain situations; (b) certain behaviors are an important part of the cognitive activity; and (c) informal learning spans individual, organizational, and environmental spheres of influence. The next chapter provides the researcher's insights into how this exploratory research study may contribute to further literature.

Chapter VII

CONCLUSIONS AND RECOMMENDATIONS

Overview

Chapter VII presents the exploratory research study's main conclusions and recommendations based on the four key findings and three analytic categories. This chapter also provides a framework of the entire research study; the research findings; and the analysis, synthesis, and interpretation of the study. Concluding remarks and recommendations for future practice and research are also discussed.

The purpose of this exploratory research study was to seek what is known about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of 12 global executives working in the United Arab Emirates (UAE) within complex adaptive systems (CAS) and their understanding of their thinking patterns that may have assisted in learning how to develop a systems thinking mental model to manage business ambiguity. The research questions sought to identify the types of experiences, perceptions, thinking patterns, and enablers—whether within the individual, organizational, or environmental context—that may have provided a strategic learning path. The aim of the exploratory research was to provide more understanding of and insights into how learning occurs in ambiguous environments.

The three research questions were: (a) What characterizes the mental models the executives hold? (the distinct nature or features of their beliefs, behaviors, and principles); (b) What are the experiences that provide the scaffolding in developing a systems thinking mental model? (experiences and events); and (c) What aspects of the individual, organizational, and environmental interactions enable executives to learn how to develop systems thinking capacity (relationships, systems, and elements)?

The qualitative study was exploratory, as Wright (1995) stated that an exploratory research focus places emphasis on understanding from the participants' point of view and has an explorative orientation and holistic perspective. The aim of this exploratory research was to seek the salient factors or variables that might be found relevant to the research (Webb, 1992). The exploratory research design included three data collection methods: semi-structured interviews, a focus group session, and a demographic questionnaire. The exploratory study design was suitable for this research study because there is a high level of uncertainty about systems thinking but limited research on adult learning frameworks for the concept of a systems thinking mental model.

Four Identified Conclusions

Four major conclusions were identified from the research findings and analytic categories and included:

1. A systems thinking mental model is reflective of and responsive to different elements, situations, and influencers.
2. Certain action-orientated behaviors are part of a systems thinking mental model.

3. Informal learning experiences in ambiguous and uncertain situations may provide an ambiguous thinking learning pathway.
4. Learning through social, cultural, and operational systems is an under-utilized strategic intent.

Conclusion #1: A Systems Thinking Mental Model Is Reflective of and Responsive to Different Elements, Situations, and Influencers

Adult educators and leadership practitioners have considerable interest in understanding a person's perspective, knowledge, and cognitive capacities. The exploratory nature of the study helped to identify various reflection mechanisms to understand the executives' mental models and their ability to manage uncertainty and ambiguity in the workplace. The executives' narratives provided significant evidence of their willingness to change their mental models when new or unique information or events warrant a change. The executives are of the notion that being able to control elements (agents) within complex adaptive systems is futile and realize the system can only change through influencing their various behavior and thinking patterns. This area of research may assist in explaining the types of perspectives required to attain a holistic social constructivist worldview to create better ambiguity coping mechanisms.

The research findings pose a strong link to the social constructivist lens which encompasses the 'social' and 'cultural' environment of how the executives can build their cognitive intellectual capacity by understanding the 'person and the environment' and the social forces that may act upon it. This was evident from the findings in which the executives found learning value by being entrenched in unique and messy situations. This could be attributed to the executives' social and cultural experiences, as 91% (11 of 12)

of the executives were expatriate employees living outside of their home country. Additionally, the executives had longevity operating in complex adaptive systems. The nature of CAS indicates there may be tension between the executives and the system due to the fluidity and ambiguity of the system. This tension may be the catalyst that enables the executives' mental models to shift and absorb confusing or conflicting information, and this tension may manifest as informal learning events that provide cognitive growth awareness.

Conclusion #2: Certain Action-Orientated Behaviors Are Part of a Systems Thinking Mental Model

The fluid and dynamic shifts within the CAS are influenced not only by external sources, but also through the behaviors of people within the system. There is evidence pointing toward learning behaviors as the executives designed their thinking mantra around a sense of learning, accumulating knowledge, building connections, critical inquiry, and seeking new ideas. Adult learning and potentially adult development researchers may be interested in continuing to link organizational psychology and organizational learning theory into business practices. For example, it may be possible to interject more visible sense making, connectivity processes, and intentional perspective-taking practices into the workplace so employees see the value of identified action-orientated behaviors: (a) seeking meaning from experiences and adopting sense-making attributes, (b) promoting critical dialogue, and (c) fostering crucial connectives to achieve greater decision quality.

It is now mainstream corporate practice for executives to analyze behaviors in the workplace through assessments, 360 reviews, executive coaching, and performance

reviews. The three different ‘competencies’ or action-orientated behaviors are deemed fundamental for a systems thinking mental model and organizational development experts and HR professionals may now have more research to verify if the behaviors can be adopted into the corporate performance and competency framework and blend in operational mechanisms to measure for the appearance of the action-orientated behaviors.

Conclusion #3: Informal Learning Experiences in Ambiguous and Uncertain Situations May Provide an Ambiguous Thinking Learning Pathway

Systems thinking requires the executives to comprehend the connectivity exemplified between the interaction of agents. The more complex the system, the more elements (nodes), connections, and interdependencies. Zimmerman (2011) stated the level of functionality of the complex systems depends on the relative connectivity of the agents. Thus, it stands to reason the executives were able to learn the dynamics of systems thinking when immersed within complex systems as there are more nodes, interconnections, and relationships to experience and learn from. For example, it may be possible to expand on perceived cognitive limiting processes in the workplace and provide employees with new duties, responsibilities, new or culturally diverse environments, or ‘stretch’ projects to develop ambiguous thinking learning opportunities.

Additionally, the concept of making meaning from experiences should be highlighted within complex adaptive systems. The dynamic flow of information and changing variables propels action forward with, perhaps, limited time allocated to reflect and make meaning of the events. Executives should gain more clarity of this adult learning concept to ensure that everyone, from all levels within the company, seeks to make meaning from informal learning events. Again, this type of responsibility may fall

on organizational development and HR professionals to build these types of learning moments and mechanisms into standard practice.

Conclusion #4: Learning Through Social, Cultural, and Operational Systems Is an Under-Utilized Strategic Intent

Small unexpected events can have a ripple effect throughout the organization and potentially cause disproportional consequences or re-occurring issues. It is evident from a scan of the executive education courses that place separate emphases on various 'leadership' and 'strategy' courses, with limited overlap in terms of reflective thinking or cognitive flexibility to promote strategic insights. Nor are there many executive strategy or leadership courses that build systems thinking or 'systems-wide understanding' as part of the strategic intent. MBA programs, which specialize in separate courses on each element of the organization, could have a specialized capstone course that integrates all the corporate interconnectedness and interrelationships with experiential learning components.

The researcher is reminded of the systems thinking premise that to find the root-cause issue, one should not look to the parts but seek to understand the wholes. Thus, the premise of the MBA program *without a capstone course* might be counterintuitive to a systems thinking mental model. For example, Sterman's MIT 'beer distribution game' may still be a relevant simulation as students were unable to see the compounding operational issues that arose when only looking at their domain requirements and failed to see the cause-effect issues. An MBA capstone course could focus on the nuances between the courses and inject competencies such as critical dialogue, reflection, and

systems thinking attributes into the course to develop more students with a systems thinking mental model.

Interestingly, certain organizational design structures work against the elements and influencers that are part of learning how to develop a systems thinking mental model. For example, typical organizations have departments that are segmented silos; performance management typically measures individual contributions; and there is more emphasis and defined criteria on hiring the technically qualified person and less on the softer skills such as identifying collaboration and inner-connectivity professional competencies. Each of these standard corporate practices provides inherent limitations to building a systems thinking mental model throughout the organization as they separate and compartmentalize information flow, and organizational development designers are always working against the 'status quo' to build in connectivity, communication, and collaboration mechanisms.

Organizational design and corporate strategists should collaborate and recognize adult learning (reflective mechanism, information learning, social constructivist lens); adopt certain behaviors (motivation to seek perspectives); embrace the will or self-efficacy (to consciously take a holistic perspective view); and use communication and connective skills (network and build a community for imbedded connectivity) to achieve corporate strategic and learning mechanisms throughout the organization.

Executive education courses (both technical and soft-skills courses) may find value in interjecting more systems thinking mental model concepts into the curriculum that align with adult learning theories (learning from experience, informal learning, social constructivist view, reflective learning); organizational learning aspects (double loop

learning, reflection in/on experience, community of practice); and complex adaptive system understanding (feedback loops, emerging elements, fluid agents, and a focus on the ‘wholes rather than the sum of parts’) to remain on track for achieving long-term strategic targets. Table 19 provides a summary of the four key findings that provided the synthesis for the four conclusions.

Table 19

Summary of Findings and Conclusions

Mental Models	Learning Architecture	Learning from Experience	Ambiguity Thinking Strategies
1. Social constructivist lens 2. Reflective thinking & practices	1. Informal learning <ul style="list-style-type: none"> • Seeks meaning from experiences and adopts sense making attributes 2. Adaptive mental models <ul style="list-style-type: none"> • Promotes critical dialogue • Fosters crucial connections 	1. Ambiguous situations 2. Exposure to alternative ways of thinking 3. Challenging assumptions	1. Be curious 2. Build community/networks 3. Develop comfort in the unknown 4. Ensure diversity of thought 5. Seek to understand person, context and the environment
Four Conclusions			
1. A systems thinking mental model is reflective of and responsive to different elements, situations, and influencers.			
2. Certain action-orientated behaviors are part of a systems thinking mental model.			
3. Informal learning experiences in ambiguous and uncertain situations may provide an ambiguous thinking learning pathway.			
4. Learning through social, cultural, and operational systems is an under-utilized strategic intent.			

Recommendations for Research

The researcher was interested with Tara Fenwick's five cognitive perspectives while writing the literature review and was seeking literature in which the cognitive complexity perspectives were an overlay to additional research studies where the five cognitive perspectives were identified. Fenwick's research formulated part of the literature review only. However, the researcher was pleased and intrigued to see the coding schemes of the executives' narratives pointing towards very complex and comprehensive reflection and perspective-taking cognitive processes. Thus, it was during the third coding level that the researcher revealed that reflective thinking and practices resulted in multiple narratives for two of the cognitive complexity perspectives, indicating a cognitive reflective mechanism to deal with the complex and puzzling CAS world. This finding may provide value for future researchers who may use Fenwick's perspectives as a guide to understanding more about cognitive perspectives and mental models in CAS or other work environments. For example, future research could develop empirical studies that seek to identify, measure, or observe the presence of the various cognitive complexity perspectives. Future research may also include *how* to develop or expand the reflective thinking and practices within the workplace.

The second level of interest was to create another body of research that links systems thinking to adult learning theories. There is surprisingly little knowledge of what systems thinking learning mechanisms are in the workplace and even less literature on how to operationalize systems thinking properties. As noted during the initial research, there is a plethora of systems thinking research from the decision sciences, biology, and ecology fields, but limited linkages to adult learning theories. Senge's work was pivotal

for introducing systems thinking to organizational learning theory, but more research is required to potentially understand how to ‘operationalize’ systems thinking mechanisms in the workplace.

Third, the researcher and her academic advisors had a few discussions on the adult development theories as they aligned with learning theories for understanding more about systems thinking. Kegan’s research on Subject-Objective Interviews (SOI) and levels of consciousness was discussed as a potential next step for future research. This may entail applying the SOI scheme as an overlay to future executives’ narratives or applying Dr. Dawson’s research from Lectica on measuring systems thinking levels to an executives’ transcript to understand what different levels of systems thinking were present. Lastly, since this research was deemed exploratory, the key findings may be useful for generating more discussion and questions about a systems thinking mental model and ambiguity thinking strategies.

Recommendations for Practice

This section of the research study provides three academic practitioner recommendations that provide socio-organizational psychologists, human resources professionals, and executives with research-based insights into how to instill components of a systems thinking mental model or, alternatively, more ambiguity thinking strategies within the workplace.

Further insights and research are required in terms of understanding systems thinking in CAS and other complex environments. It was evident there is limited awareness of this powerful thinking strategy that would be valuable for addressing

ambiguities and uncertainties in global entities. The researcher would like to springboard the terms *systems thinking mental model* and *ambiguity thinking strategies* as mainstay concepts into the organizational designer and leadership competency lexicon, where executives and organizational development professionals learn more about how to integrate reflective thinking and practices into workplace operational processes. HR professionals could tackle the issue from the origin of employment and develop recruitment tools and questions that delve into cognitive thinking patterns to verify if the candidates are able to manage and operate within complex adaptive systems through an exploration of the candidates' mental models. The further challenge is to develop more robust reflection activities in the workplace to underpin and guide executives towards more flexible and responsive ambiguity thinking strategies.

Three of the main behavior traits identified in the research study were: (a) seeks meaning from experience and adopts sense-making attributes, (b) promotes critical dialogue, and (c) fosters crucial connections. Thus, there is a potential for executive leadership researchers to verify if the two proposed leadership behavior competencies are useful in other complex or ambiguous situations as they align with other leadership theories or other work environments. In order to seek context and understanding of the person and the environment, there is an opportunity for executives to create a blameless culture by implementing after-action reviews, lessons learned, feedback sessions, and development of reflective practices, critical dialogue, and crucial connectivity links in the workplace on a more formal 'strategic intent' for improved operational effectiveness and efficiencies in the workplace to achieve strategic targets. Table 20 provides some organizational design and professional practice ideas for executives and HR professionals

to use as a road map to build a portfolio of tools, mechanisms, and practices that assist in the development of a systems thinking mental model.

Table 20

Summary of Proposed Organizational Design and Professional Practices

Research Findings Components	Ambiguity Thinking Strategy Themes	Organizational Design and Professional Practice
Adaptive mental models <ul style="list-style-type: none"> Seeking meaning from experiences and sense making attributes Promotes crucial conversations 	Be curious	<ul style="list-style-type: none"> Ladder of Inference (model) Inquiry based protocols (Check own and other's assumptions) Imbed 'continuous learning' practices (reading, discussion, sharing ideas) to explore other viewpoints Seek to discover root cause of issues Ask questions relentlessly rather than 'direct or state' opinions Implement the action-orientated behaviors into competency model
Fosters crucial connections	Build a community/networks	<ul style="list-style-type: none"> Stakeholder relationship practices Implement various community of practice (clubs and activities where ideas are shared) Create cross functional teams
Ambiguous situations	Develop comfort in the unknown	<ul style="list-style-type: none"> Leadership 'stretch' projects Cross-functional team assignments Cultural/diversity/different location assignments Causal map exercises to understand changing and uncertain variables
Exposure to alternative ways of thinking	Ensure diversity of thought	<ul style="list-style-type: none"> 360 reviews and assessments Seek a mentor Join clubs, attend seminars, view podcasts Seek new or unfamiliar activities
<ul style="list-style-type: none"> Social constructivist lens Reflective thinking & practices 	Seek to understand person, context and environment	<ul style="list-style-type: none"> Develop social, cultural and situational awareness through experiences and discussion After Action Reviews Learn self-reflective practices to seek meaning and understanding (personal and professional)

Revisiting Assumptions

It was beneficial to re-examine the five assumptions underlying the exploratory research study, as described in Chapter I. The assumptions were developed during the construction of the research problem and design. The researcher compared the original assumptions against the analysis findings with commentary.

The researcher held five assumptions related to the study. First and foremost, there was an assumption that thinking patterns may be similar to the ‘presence of a systems thinking mental model’ in the selected participants. This assumption was found to be true in a sense that the research findings and executive narratives aligned with systems thinking attributes, as noted in the literature review and conceptual framework. The executives confirmed (through their narratives) that critical dialogue, fostering connectivity, reflection mechanism, and holistic perspective taking are critical elements of a systems thinking mental model.

Second, the researcher had the assumption that the executives may not explicitly know or understand the concept of systems thinking and, to a certain extent, may not fully conduct their professional practices by seeing and understanding feedback loops, independencies, fluid and dynamic agents, or other ‘systems thinking’ terminology. This assumption was found to be true, in part, as 91% of the executives did not have any formal exposure to the concept of systems thinking which aligned with the assumption. However, 100% (12 of 12) of the executives did understand and conduct their actions by understanding feedback loops and seeing independencies and the dynamic and fluid agents, although the executives used a different vocabulary for describing the ‘people, change agents, and disruptions to the process’ of the systems thinking dynamics.

The third assumption is that within the business environment, variables influence relationships and communication patterns, and due to the dynamic nature of the environment, it is difficult to manage a business strategy without using a holistic or systems thinking management style. This assumption was true as the executive narratives pointed towards the significant learning moments that enabled the development of a systems thinking mental model and described how they used these thinking strategies in the workplace, as per Finding #4: Ambiguity Thinking Strategies.

The fourth assumption stemmed from the intention to seek more understanding from adult learning theories that provide research insights into the individual, organizational, and environmental experiential learning perspectives. The researcher believed this connection, while complex and unique to each organization, may provide a grounding for how to develop learning, behaviors, and social and structural networks in the workplace that help individuals to navigate the learning path towards their systems thinking mental models. This assumption holds true.

The researcher has a clearer structure or framework involved in the development of a systems thinking mental model based on the four key findings and the three analytical categories. There is an opportunity for organizational design specialists and executives to implement a variety of organizational mechanisms to create a blanket of systems thinking initiatives that cover various organizational and strategic priorities.

The final assumption was that an executive with a diverse background can increase corporate performances and help build the systems thinking capacity. This suggests that mental models are developed through a lifetime of experiences that shape and develop behaviors and mindsets. This assumption is true. The executives did indeed

come from diverse backgrounds and various complex adaptive domains, which provided rich and consistent results for the findings. It was evident that seeking executives who work in complex adaptive systems was part of the requirement. The researcher indicated that the development of a systems thinking mental model may be developed in different stages of career progression and is influenced by exposure to unique, messy, uncertain, and ambiguous situations.

Final Reflections

Reflecting on my academic topic of a systems thinking mental model has been an overwhelming learning and inspiring journey. As an academic practitioner, I have always been interested in executives' behaviors and cognitive complexities, and how some executives thrive in complex environments to see the subtle but important changing elements while other executives may only see the linear or most obvious surface solutions. As a researcher, I have learned a great deal about conducting qualitative research and this has fueled my interest to continue researching systems thinking, along with adaptive mental models and, subsequently, reflective thinking and practices, as these featured heavily in the coding process of the exploratory research study. As a novice systems thinker, my systems thinking learning journey was filled with my own new thinking patterns, where I was able to build better and deeper connections within my internal, organizational, and environmental spheres of influence and seek the linkages through thoughtful reflection and holistic perspective taking. The learning journey continues...

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Appendix A

Interview Executives' Excerpts

Participant	ALPHA001		
Reflective Thinking & Practices	Every morning is a safety hub, everybody, all the chief executives, all the managers and quality people, we get in a room "What happened in the last 24 hours? Were there any events? ...Then (anyone) can say what's on their mind (to share). This didn't present itself as best practice until the last five years.		
	"(After Action Reviews) It's supposed to take about 10 minutes max, but sometimes it is longer. But usually we don't try to solve problems there, we just surface (anticipated) and questions like 'did we have any errors or anything significant (to know)'".		
Learning Architecture	Adaptive Mental Models	"I think a lot. I've always been open to challenge and to learning and changing my viewpoint. If presented with new information. I would change my mind"	
	Promotes Critical Dialogue	"They have different skill sets and they complement each other. To have one person calling all the shots would not give a holistic picture".	
	Fosters Crucial Connections	"I like the excitement, the unpredictability, the comradery, the collaboration. This is always a team".	
		"In my opinion if you are putting your whole self wholeheartedly into what you are doing, you are picking up a lot of different cues and you know you are on the right track because of that intuition and it feels like you are doing the right thing". "There was comradery and yes, there was a lot of joy and learning. Yes, it was good".	
	Seeks Meaning & Adopts Sense Making Attributes	"(The unique situation) I am absorbing color, taste, touch and using all my senses to size up (the unique situation) by being in unpredictable situations and seeing all the different things, you do develop intuition based on your experiences".	
		"I was always interested early on sense making, wanting to make sense of the big picture, not just worrying about the individual patient, wanting to make sense of the overall system performance, using information to improve".	
Types of Experiences	Ambiguous Situations	"I would go visit people in rural community. Most of the people that needed your help were poverty-stricken and different things. Even in pediatrics or any type of healthcare, you never know what's coming through the door. You never know what the next admission is going to bring. You can never be fully prepared".	
		"Some of us gravitate toward it (ambiguous situations) because we like it. I've never been one who liked to have to follow a script. I like being off script. I like using my own critical thinking, coming up with ways of handling things... by being in unpredictable situations and seeing all the different things, you do develop intuition based on your experiences".	

		I think in general, I chose this profession because of its micro-organism of the whole. It has its own little ecosystem with all the elements of an independent system, but it exists within a larger system at the hospital, but can stand alone...”
	Exposure to Alternative Ways of Thinking	“Not the whole time, but much of the time, I was the only (XX) on the team. I’ve learned that diversity is really important. I have been an advocate to have additional (diversity) on the team”.
	Challenging Assumptions	“You see something highly unusual or you’ll see something that deserves attention, deconstruction, root cause analysis or other so you can figure out ‘why did that happen like that. Much of the time, what you think caused the problem is not what caused the problem and you don’t know that until you really ask a lot of questions and a lot of digging to find that out”.

Participant	CHARLIE001	
Reflective Thinking & Practices		“I think when there’s puzzling patterns, so it’s unclear, you don’t know the path ahead..... sometimes the best outcome is to do nothing. Just sit and wait and see whether you can understand what’s going on.... No one person has all the answers. What you need to do, assuming you have got a little bit of time, you should actually listen to other people, get their feedback and their view as to what they think is happening”.
		“So, I finished school at the age of 15 fully educated. An interesting situation as I entered into a managerial position with carpenters, laborers, crane drivers and construction site people who had far more experiences than me and I had to try to figure out how to actually get them to do what they had to do”.
Learning Architecture	Adaptive Mental Models	“The thing you need to understand is your next step, might be in multiple directions....If you expect the unexpected, then you pretty much deal with most issues fairly quickly”.
	Promotes Critical Dialogue	“But you’ve got to rely on people and by doing that, you create a culture of ‘solution-based thinking’. You create a learning environment that allows those learning moments to occur”.
		“So, you would always get the enthusiasm of youth and the experience of someone who’s been around awhile. And they were considered sort of equal, so everyone’s opinion had to be listened to, encouraged discussion”.
	Fosters Crucial Connections	“If you are respectful of people along the way, people will feel that and understand it and therefore will feel safer in the environment, feel safer to express their opinions and tell you know they’re feeling. Because at the end of the day, people need to not just be physically there, but mentally there as well”.
“I’ll speak to all people who work for the same company. So, whether they are a security guard or a janitor, or a managing director, every job’s important, so every individual is important. If you start from that perspective, then you’ll take time to listen to people and you’ll be able to rally people to do the extraordinary”.		

	Seeks Meaning from Experiences & Adopts Sense Making Attributes	“If we were able to do x, y, z, then perhaps we could achieve this outcome. When you’re searching for a solution to a difficult answer, then you need to involve a whole range of different people”.
Types of Experiences	Ambiguous Situations	“Once you involve people in solving really complex issues, which a number of people don’t think we’d ever be able to find a solution, it becomes contagious. It becomes a way of life. You know, I can do it and there’s no saying no to this (complex) situation”.
		“I’m sure psychologists would tell you this is significant (<i>laughter</i>) that I’m a middle child of a family of seven....I had to learn to navigate upwards, sideways, and downwards. My family moved a lot in different countries.... I jumped two grades which meant that my task of keeping up with the education and also dealing with all the people, more mature people. There is a certain element of learning to adapt”.
	Exposure to Alternative Ways of Thinking	“You can be in a discussion where you’re trying to find a solution and if you encourage every individual to actually put information on your table, then no matter how weird it might be. What’s interesting is that is actually sparks perhaps a solution from someone else”.
“You need to ensure you don’t employ look alikes. You need to have a mixture of different people... bring different personalities together because different situations will need different skills”.		
“Nothing is impossible. There’s always a solution. It’s just a matter of finding your way through that”.		

Participant	CHARLIE002	
Reflective Thinking & Practices	(Reflection in action) “It’s a really interesting paradox, in fact where the partners are going faster than the governance. That doesn’t happen too often. You have a sense of urgency, in the middle of that, using my experience, I’ve realized something else gets unlocked (in my head)”.	
	“I’m very much into this self-reflective loop. Finding the right work, then doing the work right. The crux of this is really based on the people”.	
Learning Architecture	Adaptive Mental Models	“Everything was very ambiguous and since I was so embedded in the world, I just assumed that I’m creating my own universe. If you have that approach to life and to your work, then of course you get very intimate with the activity and what’s going on.”
		“I am an information addict. I always collect all kinds of information and I have like these different piles on my desk and different folders and always learning all kinds of stuff. Just natural curiosity but I never know exactly why I need it”.
	Promotes Critical dialogue	“When I was managing big projects, you realize that’s not the management part. The management part happens between those boxes... everyone is on their own work ethics. It’s not a task, it’s

		a person. There's a heck of a lot more in that person than the thing you just told them to do... If you dare tell anyone to do anything".
	Fosters Crucial Connections	"You have the social intelligences, you have the people like me who could recognize patterns and somehow translate and communicate that. You had people who were just brains, they could mathematically do anything. You certainly gain an appreciation for it. 'Hey, if you put all this together, you could do anything in the world, literally, because you covered all the bases. That gave me real insight".
		"Once you realize the work package is a really pathetic way to help people get things done, you can hop into a different paradigm and say 'well let's aspire to do something, what do we have, what do we need? If you maintain mutual benefit constantly, then things tend to self-organize. If you're conscious about 'we are all in this together, you get something and create that value".
		I'm looking for authenticity to help me navigate. If you can find authentic people providing authentic information, that's a double confirmation so to speak. A lot of it is the people driven approach and I've learned after a while, because I used to draw myself in numbers and ask people for more numbers. It turns out that if you're just number driven, then you're only going to get as far as the mathematics can show you. If you are people driven, then you can actually discover new territory".
	Seeks Meaning from Experiences & Adopts Sense Making Attributes	"I've had the opportunity to think about that question because I was wondering why I could manage these multicultural environments and the bit of chaos navigation. It has to do with my childhood actually. It turns out that having no dad and living in a ghetto is a real good teaching experience. Realizing that crisis is a part of every day, that in the worst situation almost nobody will agree with your point of view and then maturing to the fact that there's a reason for that and then learning how to deal with that".
Types of Experiences	Ambiguous Situations	"When I get into these ambiguous and conflict situations, that's when I realize I'm in a spot where a value can happen. I feel like I'm trekking in an unknown forest looking for the big waterfall somewhere. I get very curious, I get very focused and you look for handholds in this landscape or whatever metaphors to create my path through it".
	Exposure to Alternative Ways of Thinking	"You can actually discover new territory and create something new. It's usually not driven by numbers, it's determined by a group of people trying to aspire something and willing to go on a path of discovery rather than 'what do we know".
		"I'm obviously just trying to get to the other person's perspective. Trying to find the empathy, the anchor points which can help me to create a language with that particular person or group of people. Determining what the cultural inheritance is and where are the mandate, where you are crossing the lines. You have to do

		the mapping out of the person before you go into how you are going to translate it to complexity”.
	Challenging Assumptions	“You are diving into processes and suddenly you become self-involved. You become the process, the governance of your world of perspectives. Therefore, you look perspective, you lose sight of opportunities. If you don’t reflect that ‘Hey, am I doing the right work? Not just doing what I’m doing. What I’m doing well. All kinds of that “Are you just going to go low? All kinds of good experiences, ways of involving people. What we say in business, ‘value to create’ gets lost by the wayside because you are doing what you’re doing right now very well”.

Participant	ECHO001		
Reflective Thinking & Practices		(Reflection on Action) “I think you learn through trial and error...It’s a feeling thing that comes with years of doing the same thing”.	
		(Significant learning moments) “...that comes through experience. It’s how many times you’ve been in the same situation, what mistakes have you made in the past, learning from those mistakes and then from those experiences”.	
Learning Architecture	Adaptive Mental Models	“Starting at the age of seven in boarding school, living with people from different parts of the world. Having a deposit account on your brain that you start giving criteria about different countries..... I was gathering (information) from all of these people and reinforcing actually what I had observed even as a seven-year old. You are thrown into a mini society that you have to deal with people from across the world....you quickly learn to adapt and to be able to manage your life basically while you are going through some homesickness and from the beginning, it quickly makes you an adult – in an international sense of the world”.	
	Promotes Critical Dialogue	“During my career, I probably met with a couple of hundred industrialists who own their own businesses. You learn how to talk to them, you learn how to behave in front of them, you let them do the talking more than you are doing the talking”.	
	Fosters Crucial Connections		“Those 17 years taught me a lot about people. It was all relationship based. I do that now as well. If I have people coming from overseas to Tehran and I’m there, invariably, I will always take them home. I would always have dinner for them. I would always throw a party for them. I never think that’s a waste of effort because it always comes back to assist you”.
			“People have it, they’re not brighter than the next person or harder working than the next person, but they are masterful at becoming their own “LinkedIn”. They don’t do it for a reason other than to become the focal center of the wheel”.
		“They happen in a multi-dimensional environment. As we call relationships, you just try to, firstly, listen and see what it is the other side is trying to achieve and then you have to be as clear as you can about what it is that you want”.	

	Seeks Meaning from Experiences & Adopts Sense Making Attributes	<p>“I was gathering (information) from all these different people, my friends from different parts of the world”.</p> <p>“(Information hub) you can use it in so many different ways. You can gather information. You can find potential opportunities that way. You can seek advice that way from people”.</p>
	Ambiguous Situations	<p>“I remember showing up at plants in Mexico, trying to sell them something that I had no idea what it was. I just knew how to talk to them and a rudimentary information about international trade”.</p> <p>“Since the age of about seven or eight, my parents would send me to England during the summer for two weeks to become familiar with other cultures and not to become a person who is just focused on their own country... I think that was part of my training to becoming an international executive (<i>laughter</i>)”.</p>
	Exposure to Alternative Ways of Thinking	<p>“I would say it would be critical is not to have an insular education and to travel, to get out there and see the world.....Even if it’s for a year or so, get out and experience (life)”.</p> <p>“Well most things in life are not linear. You just try to see what the other side is trying to achieve. In certain societies, that is a lot easier. If I’m talking to a European, German or Swiss banker, it’s very easy. They don’t beat around the bush.... If you’re having the same conversation in environments like the UAE or Saudi Arabia, Egypt or Iran, what the other person is telling you sometimes has five different meanings. You have to be able to read between the lines. That is the most difficult thing to do”.</p>

Participant	DELTA001	
Reflective Thinking & Practices		“I probably stepped into (the UAE) with a very American line of thinking, very western in my thinking. It was a whole different culture set within how I understood my work”.
		“That was a stunner to me. I was in a whole different culture (UAE) and now reflecting, I didn’t get it. I didn’t quite understand how these people work, the politics of it..... It was some rough roads and I got used to it and I adapted. Part of the adapting was learning how structurally things work, how decisions were made, also what autonomy that you have.... I learned through experience”.
		“Usually you put together power point arguments and everything else, but the reality, it’s the face to face that really helps make these decisions when you’re having these arguments”.
Learning Architecture	Adaptive Mental Models	<p>“It was a warning from earlier experience. Learning how to adapt with it and finding ways to be able to work through that system”.</p> <p>“Chaos is normal. Money is always an issue in most non-profits, just like it is for start-ups. Decision making has to be faster than it might be in a larger corporation.... You get it wrong, you get it wrong. Then adapt to the situation. I think that was a big part of it and challenge coming into the UAE, that you don’t get to do it that way. There are other people that have to make the decisions,</p>

		but you learn to adapt even into that type of structure of doing things, and how you might do it there versus here”.
		“There was a movement (in early 1970’s) which opened my eyes in terms of whether you want to call it radical or not, but it did give me a broader sense. The more I saw, the more I became involved in student government, student protests... it did give me a broader sense”.
	Promotes Critical Dialogue	“It’s usually the gathering of the tribe (who help with the dilemma) ‘We’ve all gone through this’ and then you start to learn the practicalities of how certain things work”.
		“It became obvious that (we) needed to have a gathering of the community with various academic institutions....”.
	Fosters Crucial Connections	“One of the things that I advocated for was (to collate) a remarkable powerful group of supporters... and make a full-scale effort to get them more involved, more engaged. Because you may need them one day when things get tough, which we all learned”.
“One of the things that I advocated for was that this was a remarkably powerful group of supporters for the institution and we really should take a full-scale effort to get them more involved and more engaged”.		
Seeks Meaning from Experiences & Adopts Sense Making Attributes	“I started a gathering (to get information), it went from 75 people to 250 people, the next event was 500 people and that was important because I learned from the collective. Actually, having a group together and bringing all these people together was kind of a radical idea at the time”.	
Types of Experiences	Ambiguous Situations	(New situation) “A thinking and hearing thoughts that I probably never heard as a Mid Westerner and became part of it. I rather liked it... It did give me a larger sense”.
	Exposure to Alternative Ways of Thinking	“I learned it through experience. I didn’t have a mentor per se. (but I found) a group of people that have had the experience”.
	Challenging Assumptions	(The insightful confrontation) “Probably a bit about the stars aligned, certainly, I think... I started to realize.... and that got my attention.”
“That gave me (a big university) ... and maybe it was the first place I really felt I could do something or maybe even fail and not be overly scared that I did that”.		

Participant	DELTA002
Reflective Thinking & Practices	“I am a reflective guy. To a fault. I guess I’m a pretty reflective kind of person. A fairly intense of my understanding is taking on so many ‘people lessons”.

Learning Architecture	Adaptive Mental Models	“I feel that it’s taken me a lifetime of experiences to get to first base (<i>laughter</i>)”.
	Promotes Critical Dialogue	“I suppose over the years, I started to think, I cannot continue to see time spent building relationship as a cost. It’s got to become an investment. It’s taken me a long time for that reality to dawn on me. It wasn’t my natural inclination.”
		“I do make a point of just trying to talk to people almost to a fault. I will solicit opinion as much as I can.... You’ll tend to come out with a different interpretation”.
	Fosters Crucial Connections	“I suppose you just either build up trust in someone or not. One of the things about being able to gather data is having a network that you can trust”.
		“We had a team. It was quite early on when I was doing public sector work. It was really interesting because this team came from strategy and alongside the transactional team, specialists, and consultants. We did not know which way to turn to unravel the problem. We didn’t even know what the problem was. Very interesting”.
	Seeks Meaning from Experiences & Adopts Sense Making Attributes	“Well it just seems so important to listen. I will use them (Emiratis) as a ‘sounding board’. Not just on the professional but on where we have to manage some of the cultural stuff because it’s just so important... even when I don’t like the answer”.
		“The culture here is extraordinary. Working here is about relationships. In some ways, it’s a little bit of privilege to be on the inside of that. It’s very easy to be on the outside. I tread carefully but I try very hard not to overstep the mark in any way to build up their trust, to respect everything they do and see”.
		“I suppose I learned to accept that things will run at their own time in their own pace. If you are someone who is task focused and wants to get something done, that can be very frustrating”.
Types of Experiences	Ambiguous Situations	“The corporate world is a jungle (<i>laughter</i>)... As an expert, you need to understand why are you here”.
		“I think ambiguity, I was thinking about this. There is a lot of ambiguity around. The majority of it is benign and circumstantial but I think that also ambiguity can be sinister when people are playing games or not sharing information or deliberately keeping you in the dark... Getting enough data together to be able to conclude not on a situation but on people’s motivation”.
	Exposure to Alternative Ways of Thinking	“My life changed when I read “Men are from Mars and Women from Venus” (<i>laughter</i>). I was a teenager when I read it, but I began to understand, a different language. It helped me decode it (perspectives). And the book ‘Thinking Fast and Slow’ by Daniel Kahnman and his phrase ‘what you see is all there is’. That struck me”.
	Challenging Assumptions	“The most dramatic learning moment to talk about respect and observing... I owe that to a cross cultural misunderstanding”.

Participant	HOTEL001	
Reflective Thinking & Practices	(After Action Reviews) “I’m massively curious to figure out why we did what we did”.	
	“I was living in Africa, we had a house keeper with eight children who was only allowed to send four of his children to school. I remember when I was five years old, I would come home from school and go to the bottom of the garden and I would teach the kids what I had learned that day at school. So, there was this early desire to share or transfer knowledge”.	
	“We have six core values and there is one that consistently isn’t lived as strongly as the other five and ‘it’s to tell you what you need to hear’. We are very good at it with our clients (<i>laughter</i>). It requires focus because it’s hard value requires you to be vulnerable and then put yourself out there and maybe feel a bit uncomfortable and you know, a tough conversation”.	
Learning Architecture	Adaptive Mental Models	“I seek out thought leaders. I try to learn from the guru’s themselves. Find those handful of thought leaders that I think can give me the mental models that help me go back to those (uncertain moments). For me it’s about shifting through and reading something new and saying, ‘Is this one of the things I can use’?”
		“You know, I suppose my opening point is just being really curious and a whole load of questions. I am typically curious less about ‘what happened’ or ‘how it happened’ but more about ‘ <i>why</i> it happened’.
	Promotes Critical Dialogue	“I’m lucky to be surrounded by really smart people who ask those ‘why’ questions”.
	Fosters Crucial Connections	“If you have a well thought out plan that nobody’s had a chance to weigh into it, it won’t get executed. (Our strategy) began with being literally surrounded with ideas and important things we thought we needed to do. It was input from everybody”.
		“I found that fascinating to just be surrounded with people who are in the same environment as you and who you could learn from. (My learning) I suppose is having the right people and that are your advisors”.
		“You know, I have spent entire meetings (asking) questions. I try to be ‘more in questions’ to get perspectives”.
		“We all get to work on our business and figure out what experiences other people had and what they’ve done. That for me has been probably the most recent leap in understanding what we would need and it’s just surrounding yourself with a core counsel”.
		“Well what’s the absolute worst thinking that can happen? Are we prepared for that to happen? So, we lose a client, or we don’t make any money on that project as long as there is no harm to another person, then okay, so what did we learn from that experience?”
Types of Experiences	Ambiguous Situations	“I think I was extraordinarily naïve when I started the business and so I probably managed ambiguity brilliantly (<i>laughter</i>) because I

		<p>didn't even know what it was. I had nothing to lose and so I think, there's the ambiguity".</p> <p>"How do I figure out the lead domino? When we start, what will have impact on something else, and then a little bit of what's reasonable for everyone to take onboard. So how do we find those real priorities and what's going to work and so really energizes by that complexity".</p>
	Exposure to Alternative Ways of Thinking	"And I think it was from this book, 'How to have a good day' by Caroline Webbs and what's the first small step that you can make".
	Challenging Assumptions	"I was working as a junior and found that I could influence and persuade people... I recall at the time thinking, it makes sense. Why wouldn't somebody have thought of it for themselves".
		"I think one of the biggest challenges as the CEO is how do you create autonomy which we know is hugely motivating for everyone so that they feel like they've got their own ownership and they can go do their own thing. But still I'm going to micromanage the detail up here, but I do want to make sure that we fix the problem down here, but so you want to dig and question, and challenge, which often makes people feel like you're micromanaging, and you don't trust them".

Participant	KILO001	
Reflective Thinking & Practices		<p>"I was born, schooled and did my undergraduate and part of my graduate studies in Lebanon during the time of the civil war (1975-1990). Growing up in this environment teaches you early on how to make critical decisions with limited information. While I do not wish for anyone to go through such a learning process, it taught me early how to make decisions with limited data, such as "is it safe to go to school today?", "how will I access the university campus if the checkpoint is closed?", "how will I access the computer lab if the power is down?". The constantly changing situation on the ground teaches you the value of dynamic thinking. Again, there must be a better way to learn these skills".</p> <p>"When you race in alpine skiing, you visualize every turn. You need to see yourself going thru every turn and assess how you've performed so far, and what you need to do in order to prepare and adapt for the next turns. One of the things that was very important for me as a racer was to learn how to visualize the entire race. Each race is comprised of around 60 turns, and each is an opportunity to excel or to fail. You're constantly adapting your approach".</p>
	Learning Architecture	Adaptive Mental Models

		<p>already leaning towards an “it depends” type of answer, until the second presented said more simply “I don’t know” and he earned my respect right there. I value this simplicity and directness”.</p> <p>“The right model for me is to learn about and develop a certain model, adopt and continuously evolve it. You have to be obsessed with the idea of constant evolution in order to achieve continuous progress”.</p>
	Promotes Critical Dialogue	<p>“I try to reach out to the guys who probably are the most insightful. They are probably not the highest in the hierarchy, but generally, they are the people who would be excited about telling you how thing works. Then you start listening and learning about the alternative models”.</p> <p>“I start with a conversation. I would go to the people who I feel are going to be the most opened minded to discuss complex issues... You need someone who’s willing to trade mind with you. The concept of trading mind is essential”.</p> <p>“Complex situations are often unlocked thru conversations. Through these fluid exchanges you get a sense of what is important and build on the different viewpoints. Solving problems by trading documented briefings is too static as a process”.</p>
	Fosters Crucial Connections	<p>“The objective is to recruit the best minds in the industry. Each one of these individuals comes with essential knowledge. When they join communities of interest, they start shaping the capabilities system that markedly impacts the way we deliver solutions in the market. This system also starts exploring new ways of doing things, triggering constant evolution”.</p> <p>“The genesis of the idea behind our start-up has been in the making for many years. As the industry gained national interest, it was important for policy makers to stimulate the development of private sector players. Unlike other tech-centric sectors I’ve been involved with, this development was short by design and had to deliver immediate impact”.</p>
	Seeks Meaning from Experiences & Adopts Sense Making Attributes	<p>“When meeting the new chairman of our client for the first time, I realized from this initial conversation that the relation wasn’t going to work as expected because we had two different thinking styles. But I noticed in the first meeting that my junior partner was able to resonate with the chairman who was clearly relating to him. I concluded that my junior partner was going to be a more efficient counterpart to frame and channel our exchanges with the chairman. I simply wasn’t the right person to drive this agenda”.</p>
Types of Experiences	Ambiguous Situations	<p>“This is a complex tech-centric industry and one that is constantly evolving. As you strive to deliver on your current engagements, and some of them are already a stretch too far from what you can deliver within your current capabilities system, new market requirements and expectations compel you to accelerate your thinking on how you can scale. It is an always-on race”.</p>
	Exposure to Alternative	<p>“Working in the advertising industry was quite interesting for me because I got to work with very talented creative people – the ones behind great advertising campaigns. Creative people tend to think</p>

	Ways of Thinking	very differently, and more freely, than their colleagues in brand management”.
		“When you are operating in emerging markets, you find yourself addressing a large spectrum of problems and challenges. You have to think constantly about what motivates others, what is their learning process, how to best communicate with them, and how to effectively advocate your position. And, you’re doing all of that in an environment that is moving rapidly. There is no room for static thinking here”.
		“I was schooled in the French system, and did all my undergrad, graduate and post-graduate studies in the American system. The French system is prescriptive and analytical; the nominal logic is to present the case through supporting data and analyses, and from there derive the conclusion. The American logic flow is more accustomed with presenting the conclusion at the start, and then walk through the supporting data and analyses. The positive side of deductive logic is that it puts a premium on how you reach your conclusion through a rigorous analytical model; it forces you to thoroughly inform your position before you can present it. The downside is that you sometimes get lost in the analytical model and surrounding narrative before you get to the so-what”.
	Challenging Assumptions	“I loved the model of strategic advocacy taught at Columbia University because it opens your eyes as to how other stakeholders are positioned vis-à-vis your advocacy, and what you can do in order to bring them closer to your line of thinking. This was an Aha! learning after 30 years as a professional”.

Participant	LIMA001	
Reflective Thinking & Practices		“How I got here is a bit of an accident. I don’t know what I bring that is necessary that special to the job or that necessary. I’m not that sure. Sometimes you say to yourself, ‘maybe this is convenient, I can take it easy. I can look at things more calmly”.
		“The learning, I have a lot of experience by now. I probably make fewer stupid mistakes than someone who starts now... I have a team and we sit together once a month... strictly speaking, the team proposes, then we debate”.
		I make forecasts and I have surprises, and I just need to make sure that in the long run, there aren’t too many negative surprises that detract from my performance. The benchmark is always the market outside there”.
Learning Architecture	Adaptive Mental Models	“Learn about institutions and how they developed historically... learn the way they operation... and keep things simple”.
		“I am interested in policy and economics and it was a good relationship with my professor who was willing to push me and my approach about the way I thought about things”.
	Promotes Critical Dialogue	“There’s always pros and cons for everything. If people (leave you alone), you can focus so there is an advantage. One has to be careful, I think because isolation is very dangerous”.

		“I often feel alone in my decisions (as boss). If someone comes to me and says something like ‘why don’t you consider this or that?’ I tend to be a good listener. There are definitely some external environmental influences that change things”.
	Fosters Crucial Connections	“I should make sure that they call me a couple times a week and that they call my team every day (for optimal results)”.
	Seeks Meaning from Experiences & Adopts Sense Making Attributes	“The biggest risk is to go a ‘formal fossilization’. You get pushed by a series of events into a comfort zone with which, over time, you grow complacent and then you’re unable to get out of it. This is particularly dangerous if you are a CEO or something”.
		“The learning. I have a lot of experience by now. There are synergies because I look back at theory, I re-look at theory. For me, it’s an opportunity to upgrade my skills”.
Types of Experiences	Ambiguous Situations	“You feel it. That you are constantly at risk. Big picture. Don’t necessarily link it to me. God knows, the guy who looks at everything in the big picture. There’s nothing ambiguity about it. It’s only about cost cutting. That’s only what it is about”.
		“When a surprise pops up, for me, the surprise pops up by definition. It doesn’t make any difference. That’s what we call ‘volatility’. That’s what we call market risk. I have it every day. It’s just part of it. It’s not a surprise within the organization or something that should not have happened that we have not planned”.
	Exposure to Alternative Ways of Thinking	“Higher academic knowledge of economics prepares you for that kind of work”.
		“I instruct part time and it gives me that opportunity to interact with students. They are just wonderful as they are very excited. Full of dreams and they ask you a lot of questions. Another thing is it allows to me to interact with (peers). Puts me in touch with lots of interesting people”.
Challenging Assumptions	“I was attracted to go and do the positive descriptive as opposed to the normative. I wanted to see all this on the other side and to see what it means to work in a private environment, private organization. I think it’s a good experience”.	

Participant	MAMA001
Reflective Thinking & Practices	“Well I think if you are an executive here (UAE) or somewhere else in the world where you’re not necessarily from, it’s a guarantee that you’re going to have to spend a lot more time on things that maybe aren’t – don’t directly have to do with your business, but it has to do with being able to get inside and understand what’s going on around you. If you don’t understand it, you can’t anticipate it; then everything will be unexpected”.
	“I guess (during those moments) you run up your personal hill to the top and scream (<i>laughter</i>) and then let the dust settle and I try to reflect it back.... So, I try to find out the frustration and reflect on that”.

		<p>“Well, what resonated with me is like you know... I thought the way you progressed in your career is based on knowledge and technical abilities and slowly you find out there’s a lot of other things that has to do with how far you actually get. Your basic expertise gets you to a certain level and then you realize that you actually don’t know that much and there’s a lot that you haven’t tapped into”.</p>
		<p>“You have to understand the different drivers because it is not always clear at first sight. And so, you find yourself spending more and more time trying to understand what drives people”.</p>
Learning Architecture	Adaptive Mental Models	<p>“(The agenda is not progressing) ... so I need to find out what is missing, and it means that there’s something going on that I don’t know about. I try to reflect back on it and go okay, what is it I haven’t seen”.</p>
		<p>“We all have a sort of common language we do in business regardless of whether your friends are Canadian or Dutch or other. Business... there’s always forces at play I guess, that we can’t see but they have to do with financial experiences or maybe politics...other elements of socio-economic are not immediately visible”.</p>
	Promotes Critical Dialogue	<p>“It’s also about recognizing what you’re not good at and I think for me, I’ve been able to, especially in the last couple of years, I just focused on getting the best people around me. Preferably people who are much smarter than I am or much better at this”.</p>
		<p>“Because every senior executive or general manager has to make that transition between ‘I’m the expert and I’m going to tell everyone body what to do’ which limits your capacity, ability and horse power, and you must engage with people on a more personal level”.</p>
	Fosters Crucial Connections	<p>“But then there will be a lot of forces at play I don’t understand. I can’t get to work. There will be politics and local agendas. So, I need to first find people to educate me on how this whole thing works”.</p>
		<p>“It will be between customer, employees and shareholders. Now it’s a balance. One of the three is going to be unhappy, so you can never look only at the financial returns. You also need to look at the softer side of things... how does everyone get to share in the additional value being created”.</p>
<p>“As a business leader, you have to understand your environment and having the right networks to do your business.... Try to add value to the society around you, social economic value or maybe even political value, then I think you develop a system”.</p>		
Seeks Meaning from Experiences & Adopts Sense Making Attributes	<p>“Nobody prepares you... cultural diversity... You go to a different culture and suddenly you find out that the common language you used, or the common standards or the common policies and protocols, they don’t work as well as you expect. So now you need to go and find out why and ways to understand why that is”.</p>	

Types of Experiences	Ambiguous Situations	“It was almost impossible to deliver. It was two years of hardships. A lot of stress. 24/7 working, there was not a social life, but it was really rewarding because I found ways... I discovered a lot of new ways to find solutions to problems”.
	Exposure to Alternative Ways of Thinking	“I went from Europe to Asia, North American then to the Middle East and you know, you need to get tested (to know people). If you want to prepare people (for career), you need to go to a different culture”.
		“I couldn’t get my arms around a few things (local labor situation) with lots of people from Yemen, Oman, India and Philippines and what I find out is that if 20% of the workforce does not show up, it has something to do with a celebration or something. And you know, that’s when you get into learning about certain values, systems. As so I looked at getting advice.... and visit the Sheikh of those tribes.... So, I found out that there’s all these different structures and the way societies are managed.... If you don’t want to understand it, you are going to have an issue, so you have to adjust”.
	Challenging Assumptions	“I asked for advice. I was lucky to have a chairman that helped me out a lot and educated me if you will”.

Participant	MAMA002	
Reflective Thinking and Practices		“I used to be a very fast decision maker, but now I am calmer. Thinking. I have a thinking process and learned how to structure things...(based on) reflecting on previous experiences”.
		“When I came (to the business), I was isolated. I was shy. It is not the way and you need to push yourself so eventually you go to places that you don’t want to go, meet people that you don’t want to me and I started to learn. I got more confident”.
		“There’s a complex pathway or there’s no pathway.... I eventually go back to my mentor and we discuss options”.
Learning Architecture	Adaptive Mental Models	“There is always a pathway. There is always a pathway somewhere. If it’s a complex pathway or no previous pathway, I eventually go back to my mentor to help provide a vision of how things can be done”.
	Promotes Critical Dialogue	“The real intent. I don’t depend (on information) from one person. I seek multiple sources...If I don’t get the answers that satisfies me, I evaluate and keep evaluating...”
		“Getting information is important and here is the UAE, visiting the majalis is how you get information. It might be rumor. It might be truth, but eventually you confirm it (the information). How I do it and how I control or organize the information is that I tend to go to the organization itself and ask to lower the risk of uncertainty”.
	Promotes Crucial Connections	“Meeting other government officials or JV partners, that’s how I learn... Sometimes I don’t have the answer and you might need a lot of people. You follow up with the government, the sector and consultants”.

		“Most of our partnerships are recommended. However, we tend to go there. Travel to their country and meet the executive there (to learn more)”.
	Seeks Meaning from Experiences & Adopts Sense Making Attributes	“There’s uncertainties... It’s not like something is unexpected. When a company is 50 years old... It’s like a cycle”.
		“There is always a stepping stone before it (ambiguity) comes”.
Types of Experiences	Ambiguous Situations	“Nothing comes easily. It starts being hard, but then it becomes the norm”.
	Exposure to Alternative Ways of Thinking	“I have a mentor. He’s more experiences than me..... I also have a (colleague) who (shows) me alternatives steps to problem solving with structuring deals. We do work sessions. We do writing on the walls. We are transparent”.
		“Most of my learning is through meeting people. While (the other party) is talking, I get to learn. I do my homework and I come back and sit down (again) with him, understand the process, and eventually do business together”.
	Challenging Assumptions	“Sometimes I don’t have the answer. You meet a lot of people (to learn more)”.
“When I came into the business, I got pushed. You have to do something that is not relaxing to get you out of the (comfort) box”.		


Participant	ROME001	
Reflective Thinking & Practices	“You have principles, you know, you have hindsight. A perspective. If there is no precedence, if you try hard enough, you will find that even if you set your imagination on whatever information you have available, you can compile imaginary precedence. And just provide context for the situation. It sounds mad (<i>laughter</i>)...So I think history is important and being able to recognize patterns”.	
Learning Architecture	Adaptive Mental Models	“I was forced to become humble after (a situation). ...definitely a mindset shift was required, and it was very painful”.
	Promotes Critical Dialogue	“I think I’m a pretty vocal person who tries to get people excited about the responsibility we co-share...And being excited about being able to communicate in a way that excites others”.
		“Building a future team, you take stock of resources you bring to the table and find a way to piece that basket of offering that is impactful and sustainable”.
	Fosters Crucial Connections	“Basically, you need to find a way to bring fun to discipline. Otherwise (work) becomes boring. Different people have different capabilities and people have good days and bad days. But in general, if you manage to bring a community around you, that respects that value. A brand, a style of having fun while executing”.
“I think with ‘buy in’ and winning people over, working on your partners journey.... That part of your journey is critical”.		

		<p>“I ask myself if I have the experience and can I facilitate through my network, personal and professional network. Can I facilitate or accelerate a certain outcome? Do I have the mandate or even earned the mandate? Build a mandate to shield or protect those people you think you are leading”.</p>
		<p>“Cause it’s your perception. How real is that? How much do you know? How much investment are you going to put on top of that understanding? Analogies are important to focus on communicating your perspective of the system to others/stakeholders. It goes a long way from values perspectives and people who are somewhat aligned”.</p>
	Seeks Meaning from Experiences & Adopts Sense Making Attributes	<p>“I’m imperfect as they are, and I was really lucky. It’s not like doors were opening. No, it was actually mostly doors closing, but having resilience to show up again and again, to find ways to bring people along and... that is priceless”.</p>
		<p>“(The complex situation) I solved it, myself. A little bit of chance and a little bit of pointing in the right direction and insisting on it. Sometimes when you feel grumpy and upset, maybe that is the fuel that is required to point you in a specific direction to keep you ‘resilient’”.</p>
		<p>“I taught myself to defend for some reason... Injustice bugs me and makes me feel like I need to do something”.</p>
Types of Experiences	Ambiguous Situations	<p>“If you can find parallels that your audience can understand, then you can fill in another shade or hue in the picture of the painting that’s in their mind”.</p>
	Exposure to Alternative Ways of Thinking	<p>“There’s really a lot of ways you can look at any set of data or information when using systems thinking. To be able to focus that though around communicating with others who are involved. That goes a long way in delivering anything”.</p>
		<p>“I think a leader’s role is to be someone who can coordinate different views in a somewhat sensitive way”.</p>
	Challenging Assumptions	<p>“Opportunity didn’t just knock on my door. You had to have tenacity... you have to be looking for it. (opportunity) Put as much effort as you can, use your network to become visible and put yourself out there”.</p>

Appendix B

Demographic Questionnaire

Please complete the Demographic Questionnaire

Item	Response
List your gender	____ Male ____ Female
Identify your age bracket	____ Below 30 years ____ 31-40 years ____ 41-50 years ____ 51-60 years ____ 60+ years
List your nationality	_____
List the length of time working in the United Arab Emirates (UAE)	____ Below 10 years ____ 10-15 years ____ 16-20 years ____ 21-25 years ____ 26-30 years ____ 30+ years
List the length of time working within Complex Adaptive Systems (CAS) or ambiguous work environments	____ 10-15 years ____ 16-20 years ____ 21-25 years ____ 26-30 years ____ 30+ years
List your Degrees obtained and the name of the degree	____ Bachelor's degree Name: ____ ____ Master's degree Name: ____ ____ Doctorate Degree Name: ____
List your number of languages spoken	Language #1 _____ Language #2 _____ Language #3 _____
List the countries in which you have worked	Country #1: _____ Country #2: _____ Country #3: _____ Country #4: _____
List the title of your current position	_____
Identify if participating in interview or focus group	____ Interview ____ Focus Group
The Researcher will add the code name of the participant	

Appendix C

Interview Informed Consent Form

INFORMED CONSENT

Protocol Title: The Systems Thinking Learning Lens:
An Exploratory Study of Executives Mental Models
Interview Consent
IRB Protocol Number: 18-104

INTRODUCTION

You are being invited to participate in this research study called “The Systems Thinking Learning Lens: An Exploratory Study of Executives Mental Models.” You may qualify to take part in this research study because you are a key global executive with vast experiences living and working in the United Arab Emirates within complex and ambiguous work environments. Exploring how you draw inferences on past personal and professional experiences, define the influencers, elements and the different perceptions to make informed decisions, may provide a mind-set blueprint or ‘mental model’ on how future leaders can learn to develop systems thinking mental models within ambiguous and uncertain situations.

Approximately fifteen people will participate in this study.

WHY IS THIS STUDY BEING DONE?

The research is a qualitative exploratory research study that seeks to expand what is known and unknown about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of various global executives working in the United Arab Emirates and their understanding of how they learned to develop their systems thinking mental models to manage business ambiguity. The significance of the study may provide more understanding and insights into how others can learn to enhance their own systems thinking capacity in ambiguous environments.

WHAT WILL I BE ASKED TO DO IF I AGREE TO TAKE PART IN THIS STUDY?

If you decide to participate, you will be asked to conduct a face to face interview with the researcher at the time and location that provides privacy and is agreeable to you and the researcher. In case of any constraints, the interview can also be conducted via Skype or WebEx.

With your permission, the interview will be audio recorded. However, if you do not wish to be audio-recorded, you will not be able to participate.

Your participation will take approximately 90 minutes, which consists of the following activities:

1. Complete the Informed Consent Form
2. Complete the face-to-face interview
3. Complete the Demographic Questionnaire

The interview questions and terminology of the study will be provided in advance of the scheduled meeting to assist in providing more context for the interview.

WHAT POSSIBLE RISKS OR DISCOMFORTS CAN I EXPECT FROM TAKING PART IN THIS STUDY?

Your participation in the study is strictly voluntary. The researcher anticipates that there will be no greater risk or discomfort associated with participating in this study than in any other typical interview or discussion situation. What you are willing to share is entirely up to you.

WHAT POSSIBLE BENEFITS CAN I EXPECT FROM TAKING PART IN THIS STUDY?

There is no direct benefit from the participation.

WILL I BE PAID FOR BEING IN THIS STUDY?

You will not be paid to participate.

WHEN IS THE STUDY OVER? CAN I LEAVE THE STUDY BEFORE IT ENDS?

You are requested to complete the interview and the Demographic Questionnaire. You may withdraw from your participation at any point of the process without any penalty.

PROTECTION OF YOUR CONFIDENTIALITY

The protection of your privacy is of highest priority to the researcher as part of this research study, therefore in order to ensure your confidentiality, the audio recordings will be stored, password protected in a secure place that is only accessible to the researcher.

The researcher will utilize a professional transcription service in which a Non-Disclosure Agreement is used, and the transcription service will delete all audio recordings after the transcript is provided. Once the analysis of the data is finalized, the researcher will delete all audio recordings.

The researcher will protect your identity and provide you with a numeric code and eliminate any identifiers from the data. Moreover, the researcher will password protect all data in the soft copy folder on her personal computer.

HOW WILL THE RESULTS BE USED?

The researcher will use the findings in partial completion of her dissertation as part of the doctoral program in the field of adult learning and leadership at Teacher's College, Columbia University. The results may also be used for publication in journals or articles or other educational purposes.

CONSENT FOR AUDIO RECORDING

Audio recording is part of this research study. If you decide that you don't wish to be recorded, you will not be able to participate in this research study.

_____ I give my consent to be recorded. Signature: _____

_____ I **do not** consent to be recorded. Signature: _____

WHO MAY VIEW MY PARTICIPATION IN THIS STUDY?

___ I consent to allow written and/or audio taped materials viewed at an educational setting or at a conference outside of Teachers College. Signature: _____

Signature

___ I **do not** consent to allow written and/or audio taped materials viewed outside of Teachers College Columbia University. Signature: _____

OPTIONAL CONSENT FOR FUTURE CONTACT

The investigator may wish to contact you in the future for additional questions or clarifications. Please initial the appropriate statements to indicate whether or not you give permission for future contact.

I give permission to be contacted in the future for research purposes:

Yes _____ No _____ Initial

I give permission to be contacted in the future for information relating to this study:

Yes _____ No _____ Initial

WHO CAN ANSWER MY QUESTIONS ABOUT THIS STUDY?

If you have any questions about taking part in this research study, you should contact the principal investigator, Debbie Sutherland +971 50 311 7492 or ds3252@tc.columbia.edu

If you have questions or concerns about your rights as a research subject, you should contact the Institutional Review Board (IRB) (the human research ethics committee)

at 212-678-4105 or email IRB@tc.edu. Or you can write to the IRB at Teachers College, Columbia University, 525 W. 120th Street, New York, NY 1002. The IRB is the committee that oversees human research protection for Teachers College, Columbia University.

PARTICIPANT'S RIGHTS

I have read and discussed the informed consent with the researcher. I have had ample opportunity to ask questions about the purposes, procedures, risks and benefits regarding this research study.

I understand that my participation is voluntary. I may refuse to participate or withdraw participation at any time without penalty.

The researcher may withdraw me from the research at his or her professional discretion.

If, during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue my participation, the investigator will provide this information to me.

Any information derived from the research study that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.

I should receive a copy of the Informed Consent document.

My signature means that I agree to participate in this study

Print name: _____ **Date:** _____

Signature: _____

Appendix D

Focus Group Informed Consent Form

INFORMED CONSENT

Protocol Title: The Systems Thinking Learning Lens:
An Exploratory Study of Executives Mental Models
Focus Group Consent
IRB Protocol Number: 18-104

INTRODUCTION

You are being invited to participate in this research study called “The Systems Thinking Learning Lens: An Exploratory Study of Executives Mental Models.” You may qualify to take part in this research study because you are a key global executive with vast experiences living and working in the United Arab Emirates within complex and ambiguous work environments. Exploring how you draw inferences on past personal and professional experiences, define the influencers, elements and the different perceptions to make informed decisions, may provide a mind-set blueprint or ‘mental model’ on how future leaders can learn to develop systems thinking mental models within ambiguous and uncertain situations.

Approximately 7 people will participate in the focus group session.

WHY IS THIS STUDY BEING DONE?

The research is a qualitative exploratory research study that seeks to expand what is known and unknown about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of various global executives working in the United Arab Emirates and their understanding of how they learned to develop their systems thinking mental models to manage business ambiguity. The significance of the study may provide more understanding and insights into how others can learn to enhance their own systems thinking capacity in ambiguous environments.

WHAT WILL I BE ASKED TO DO IF I AGREE TO TAKE PART IN THIS STUDY?

If you decide to participate, you will be asked to participant in a focus group session with the researcher at a time and location that provides privacy and is agreeable to you and the researcher. The focus group activity and discussion forms part of the research design for data collection.

With your permission, the focus group session will be audio recorded. However, if you do not wish to be audio-recorded, you will not be able to participate.

Your participation will take approximately 90 minutes, which consists of the following activities:

1. Complete the Informed Consent Form
2. Complete the Focus Group session
3. Complete the Demographic Questionnaire

The focus group session overview and terminology of the study will be provided in advance of the scheduled meeting to assist in providing more context for the focus group.

WHAT POSSIBLE RISKS OR DISCOMFORTS CAN I EXPECT FROM TAKING PART IN THIS STUDY?

Your participation in the study is strictly voluntary. The researcher anticipates that there will be no greater risk or discomfort associated with participating in this study than in any other typical discussion situation. What you are willing to share is entirely up to you.

WHAT POSSIBLE BENEFITS CAN I EXPECT FROM TAKING PART IN THIS STUDY?

There is no direct benefit from the participation.

WILL I BE PAID FOR BEING IN THIS STUDY?

You will not be paid to participate.

WHEN IS THE STUDY OVER? CAN I LEAVE THE STUDY BEFORE IT ENDS?

You are requested to participate in the Focus Group and the Demographic Questionnaire. You may withdraw from your participation at any point of the process without any penalty.

PROTECTION OF YOUR CONFIDENTIALITY

The protection of your privacy is of highest priority to the researcher as part of this research study, therefore in order to ensure your confidentiality:

The researcher will utilize a professional transcription service in which a Non-Disclosure Agreement will be used, and the transcription service will delete all audio recordings after the transcript is provided. Once the analysis of the data is finalized, the researcher will delete all audio recordings.

The researcher will protect your identity and provide you with a numeric code and eliminate any identifiers from the data. Moreover, the researcher will password protect all data in the soft copy folder on her personal computer.

Your identity will be known to other focus group participants and researcher cannot guarantee confidentiality of the group. We will ask that you keep all comments made during the focus group confidential and not discuss what happened during the focus group outside the meeting.

HOW WILL THE RESULTS BE USED?

The researcher will use the findings in partial completion of her dissertation as part of the doctoral program in the field of adult learning and leadership at Teacher's College, Columbia University. The results may also be used for publication in journals or articles or other educational purposes.

CONSENT FOR AUDIO RECORDING

Audio recording is part of this research study. If you decide that you don't wish to be recorded, you will not be able to participate in this research study.

_____ I give my consent to be recorded. Signature: _____

_____ I **do not** consent to be recorded. Signature: _____

WHO MAY VIEW MY PARTICIPATION IN THIS STUDY?

___ I consent to allow written and/or audio taped materials viewed at an educational setting or at a conference outside of Teachers College. Signature: _____

___ I **do not** consent to allow written and/or audio taped materials viewed outside of Teachers College Columbia University. Signature: _____

WHO CAN ANSWER MY QUESTIONS ABOUT THIS STUDY?

If you have any questions about taking part in this research study, you should contact the principal investigator, Debbie Sutherland +971 50 311 7492 or ds3252@tc.columbia.edu

If you have questions or concerns about your rights as a research subject, you should contact the Institutional Review Board (IRB) (the human research ethics committee) at 212-678-4105 or email IRB@tc.edu. Or you can write to the IRB at Teachers College, Columbia University, 525 W. 120th Street, New York, NY 1002. The IRB is the committee that oversees human research protection for Teachers College, Columbia University.

PARTICIPANT'S RIGHTS

I have read and discussed the informed consent with the researcher. I have had ample opportunity to ask questions about the purposes, procedures, risks and benefits regarding this research study.

I understand that my participation is voluntary. I may refuse to participate or withdraw participation at any time without penalty.

The researcher may withdraw me from the research at his or her professional discretion.

If, during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue my participation, the investigator will provide this information to me.

Any information derived from the research study that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.

I should receive a copy of the Informed Consent document.

My signature means that I agree to participate in this study

Print name: _____ **Date:** _____

Signature: _____

Appendix E

Introductory Email/Letter-Interview

Dear Executive,

The purpose of this letter is to invite you to participate as an interview participant in an exploratory research study for my Columbia University doctorate program. The study is titled “The Systems Thinking Learning Lens: An Exploratory Study of Executives Mental Models” and the study seeks to expand what is known and unknown about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of various global executives working in the United Arab Emirates (UAE) and their understanding of how they learned to develop their systems thinking mental models to manage business ambiguity.

The aim of the exploratory research is to explore more understanding and insights into how learning occurs for the selected participants in ambiguous environments. The significance of the study may provide more understanding and insights into how others can learn to enhance their own systems thinking capacity in ambiguous environments.

As you are a key global executive with vast experiences living and working in the United Arab Emirates within complex and ambiguous work environments, exploring how you draw inferences on past personal and professional experiences, define the influencers, elements and the different perceptions to make informed decisions, may provide a mind-set blueprint or “mental model” of how future leaders can learn to develop systems thinking mental models within ambiguous and uncertain situations.

If you choose to be a participant in the study as an interview participant, you will be asked to complete a face-to-face 60-minute interview with the researcher, Debbie Sutherland, and complete three documents, the Informed Consent Form, Participant’s Rights Form and the Demographic Questionnaire.

Any information collected will be held in the strictest confidence and no individual or company identifiers will be disclosed in the dissertation discussion, narrative or in academic or professional circles. All information will be kept in a password protected file in which only the researcher will have access.

Attached you will find the following documents:

- Copy of the Introductory Letter
- Participant’s Rights Form
- Informed Consent Form

Please take the time to review these documents. If you wish to participate in the study, please respond to this email with the signed Informed Consent Form and we can initiate the interview scheduling.

Thank you for your time and consideration.

Best Regards

Debbie Sutherland

Appendix F

Introductory Email/Letter-Focus Group

Dear Executive,

The purpose of this letter is to invite you to participate as a Focus Group participant in an exploratory research study for my Columbia University doctorate program. The study is titled “The Systems Thinking Learning Lens: An Exploratory Study of Executives Mental Model” and the study seeks to expand what is known and unknown about learning how to develop a systems thinking mental model by exploring the perceptions and narratives of various global executives working in the United Arab Emirates (UAE) and their understanding of how they learned to develop their systems thinking mental models to manage business ambiguity.

The aim of the exploratory research is to explore more understanding and insights into how learning occurs for the selected participants in ambiguous environments. The significance of the study may provide more understanding and insights into how others can learn to enhance their own systems thinking capacity in ambiguous environments.

As you are a key global executive with vast experiences living and working in the United Arab Emirates within complex and ambiguous work environments, exploring how you draw inferences on past personal and professional experiences, define the influencers, elements and the different perceptions to make informed decisions, may provide a mind-set blueprint or “mental model” of how future leaders can learn to develop systems thinking mental models within ambiguous and uncertain situations.

If you choose to be a participant in the study as a Focus Group participant, you will be asked to complete a 60-minute focus group session and complete three documents; the Informed Consent Form, Participant’s Rights form and the Demographic Questionnaire.

Any information collected will be held in the strictest confidence and no individual or company will be disclosed in the dissertation discussion, narrative or in academic or professional circles. All information will be kept in a password protected file in which only the researcher will have access.

Attached you will find the following documents:

- Copy of the Introductory Letter – Focus Group
- Participant’s Rights Form
- Informed Consent Form

Please take the time to review these documents. If you wish to participate in the study, please respond to this email with the signed Informed Consent Form and we can initiate the focus group scheduling.

Thank you for your time and consideration.

Best Regards
Debbie Sutherland

Appendix G

Terminology and Interview Questions

The terminology that was used in this study has been defined as follows and a more comprehensive research on the terms is reviewed in the literature review.

Ambiguous Environments: Ambiguity can be described as environments that have an “ongoing stream that supports several different interpretations at the same time” (Weick, 1995, p. 91) as well as environments or situations in which “the nature of the problem is itself in question, information reliability is problematic, goals are unclear or conflicting, contradictions and paradoxes appear, and poor understanding of cause-effect relationships” (McCaskey, 1982, p. 93).

Ambiguity Thinking Strategies: The term *ambiguity thinking strategies* provides an organizational operational perspective on how cognitive learning practices may provide context and understanding on how executives can align inexactness, paradoxes, or uncertain situations (ambiguity) within the business context (principles and practice) and the ideal conditions (influencers, elements, interactions and knowledge making architecture) to create an ideal learning pathway to assist in the development of a systems thinking mental model.

Complex Adaptive Systems: These systems involve many components that adapt or learn as they interact. Defined by “many components and as each component affects, and is affected by, every other component within the boundaries of the systems such that one cannot appreciate the systems whole by simply examining the parts” (Holland, 2005, p. 1).

Systems Thinking: Systems thinking is the art and science of making reliable inferences about behavior, people and systems by developing an increasingly deep understanding of the underlying structure and the fluid agents that interact to change the structure (Richmond, 1994). It also involves seeing the behavior of a system change through changing variables and as a “discipline for seeing wholes and seeing interrelationships rather than things and seeing patterns of change rather than snapshots” (Senge, 1990, p. 68).

Mental Models: Mental models involve the cognitive complexity activity of “representing objects, states of affairs, sequences of events, the way the world is and the social and psychological action of daily life. They enable individuals to make inferences and predictions, to understand phenomena, to decide what action to take and to control its execution and above all, the experience events by proxy” (Johnson-Laird, 1983, p. 397).

Systems Thinking Mental Model: The cognitive and behavior capacity to reflect on, examine, and adapt perspectives to seek meaning from dynamic connections, interactions, experiences and behaviors to determine the ideal decision pathway. A systems thinking mental model may provide more understanding of how to leverage the fluidity of uncertain situations from the individual, organizational, and environmental perspectives to increase learning and collective understanding of how to support positive outcomes.

Successful Executives: Top-level executives or “elites” operating in the business, academic, or government domain that may hold titles such as CEO, CFO, or President, or hold a position within one reporting line from the highest executive position in the company. The participants can be classified as “elites,” which are defined as those

individuals with “power and influence and are considered influential, prominent, and/or well informed in an organization or community and are selected for their in-depth perspectives” (Marshall & Rossman, 2010, p. 158). The executives must have worked in the UAE and in at least two different CAS or positions with ambiguity elements for at least 10 years in total.

Sense making: Sense making is described as the developing set of ideas with explanatory possibilities (Weick, 1995), a “construction of the unknown” (Waterman, 1990, p. 41), and involves “placing stimuli into some kind of framework” (Dunbar, 1981, p. 397); see also Goleman, 1985; Starbuck & Milliken, 1988).

Interview Questions

Informed Area	Interview Questions
RE: Distinct nature or features of beliefs, behaviors and principles (mental models)	1.1. Tell me a little bit about your background and upbringing. 1.2. It is becoming more difficult to predict business outcomes as the rapid pace of change, interconnectedness and the layers of dependencies increases, patterns and cycles of events, plethora of information and fluidity of relationships. Tell me how you try to understand the ambiguity within the workplace? 1.3. What is your perception/beliefs of the unexpected changes/errors that occur in your workplace due to these challenges? 1.4. When ambiguity create challenges describe your thinking and behavior during these situations. And what type of feelings occur?
RE: The scaffolding: experiences and events (learning strategies)	2.1. When faced with a puzzling pattern of events, what experiences or significant learning moments helped you to understand or anticipate the next step? What did you pay attention to? 2.2. Described the scenario(s) that helped you learn or shape your thinking style? (good or bad scenarios)
RE: Influencing factors from the individual, organizational and environmental interactions relationships, and systems (systems thinking elements)	3.1 Describe to me when or where the ‘good’ learning moments occur . What elements, environments, people or influencers are present? 3.2. Describe if your ‘ambiguity management’ style has changed over time. What has influenced the changes? 3.3 If you were to guide future leaders on developing a systems thinking mental model, what would be the one or two key learning lessons?

Appendix H

Terminology and Focus Group Session

The terminology that was used in this study has been defined as follows and a more comprehensive research on the terms is reviewed in the literature review.

Ambiguous Environments: Ambiguity can be described as environments that have an “ongoing stream that supports several different interpretations at the same time” (Weick, 1995, p. 91) as well as environments or situations in which “the nature of the problem is itself in question, information reliability is problematic, goals are unclear or conflicting, contradictions and paradoxes appear, and poor understanding of cause-effect relationships” (McCaskey, 1982, p. 93).

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Complex Adaptive Systems: These systems involve many components that adapt or learn as they interact. Defined by “many components and as each component affects, and is affected by, every other component within the boundaries of the systems such that one cannot appreciate the systems whole by simply examining the parts” (Holland, 2005, p. 1).

Systems Thinking: Systems thinking is the art and science of making reliable inferences about behavior, people and systems by developing an increasingly deep understanding of the underlying structure and the fluid agents that interact to change the structure (Richmond, 1994). It also involves seeing the behavior of a system change through changing variables and as a “discipline for seeing wholes and seeing interrelationships rather than things and seeing patterns of change rather than snapshots” (Senge, 1990, p. 68).

Mental Models: Mental models involve the cognitive complexity activity of “representing objects, states of affairs, sequences of events, the way the world is and the social and psychological action of daily life. They enable individuals to make inferences and predictions, to understand phenomena, to decide what action to take and to control its execution and above all, the experience events by proxy” (Johnson-Laird, 1983, p. 397).

Systems Thinking Mental Model: The cognitive and behavior capacity to reflect on, examine, and adapt perspectives and to seek meaning from dynamic connections, interactions, experiences and behaviors to determine the ideal decision pathway. A systems thinking mental model may provide more understanding of how to leverage the fluidity of uncertain situations from the individual, organizational, and environmental perspectives to increase learning and collective understanding of how to support positive outcomes.

Successful Executives: Top-level executives or “elites” operating in the business, academic, or government domain that may hold titles such as CEO, CFO, or President, or hold a position within one reporting line from the highest executive position in the company. The participants can be classified as “elites,” which are defined as those

individuals with “power and influence and are considered influential, prominent, and/or well informed in an organization or community and are selected for their in-depth perspectives” (Marshall & Rossman, 2010, p. 158). The executives must have worked in the UAE and in at least two different CAS or positions with ambiguity elements for at least 10 years in total.

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Focus Group Session Activity

The researcher will begin the session with an overview of the exploratory study, the terminology and focus group protocols. The design of the focus group activity will be: concept mapping to experientially introduce systems thinking. The activity will be introduced to the participants as an activity to use concept mapping to explore a complex or ambiguous issue(s) the participants may have faced in the workplace. The participants will develop a concept map based on their knowledge of the factors that affect the components of the map. The researcher will encourage the participants to work through the situation by highlighting the elements, interactions and feedback components within the map. Following the mapping exercise, the participants will be asked to examine how the methods of fixing the problem have unintended consequences throughout the map.

The discussion portion of the session will be to ask the participants will be asked to describe their thinking strategies while dealing with ambiguity and during the activity

process. The participants will be asked to add their coded numeric names to the back of the concept maps.

Appendix I

Interview Demographic Summary

Demographic Area	Interview Group		
Gender	16% Female / 83% Male		
Age	50% between 51-60 years	33% between 41-50 years	16% between 61+ years
Nationality	33% American 16% British 16% Lebanese (One Lebanese self-identified as Lebanese Canadian) 8% Italian 8% Dutch 8% Emirati 8% New Zealander		
Length of Time working in UAE	50% below 10 years 16% between 10-15 years 0% between 16-20 years 16% between 21-25 years 8% between 26-30 years 8% between 31+ years		
Length of Time Working in CAS or ambiguous work environments	8% between 11-15 years 33% between 16-20 years 33% between 21-25 years 25% between 31+ years		
List Degrees Obtained	91% have Bachelor 's Degree	Science, Political Science, Engineering, Mechanical Engineering, University Admin & Community Development, Economics, Quantity Surveyor, Industrial Engineer, Nursing and Business	
	75% have Master's Degree	College Admin & Human Relations, Economics & Information Management, Information Systems, MBA	
	8% have second master's degree	Master of Science, MBA	
	25% have Doctorate Degree	Economics, Nursing, DBA	
List Languages Spoken	100% speak native language	English, Arabic, Italian	
	63% speak a second language	English, French, Arabic, Farsi	
	41% speak a third language	Dutch, German, Danish, Arabic, French	

List countries in which they have worked	100% worked in native country	UK, USA, New Zealand, Lebanon, Canada, The Netherlands, Italy, UAE
	100% worked in UAE	<i>Part of participant selection</i>
	58% worked in three countries	Russia, Malaysia, France, Africa
	41% worked in four countries	Switzerland
List current job titles	CEO, Executive Director, Managing Director, Advisor, Head, Chief	

Appendix J

Focus Group Demographic Summary

Demographic Area	Focus Group		
Gender	16% female / 83% male		
Age	16% between 31-40 years	66% between 41-50 years	16% between 51-60 years
Nationality	16% Emirati 32% American, 32% British 16% Canadian		
Length of Time working in UAE	32% below 10 years 16% between 10-15 years 16% between 16-20 years 0% between 21-25 years 32% between 26-20 years 0% between 31+ years		
Length of Time Working in CAS or ambiguous work environments	66% between 11-15 years 16% between 16-20 years 16% between 21-25 years 0% between 31+ years		
List Degrees Obtained	83% have bachelor's degree	Business, Architecture, Communication	
	32% have master's degree	MBA	
	0% have second master's degree		
	0% have Doctorate Degree		
List Languages Spoken	100% speak native language	English, Arabic	
	66% speak a second language	English, Arabic, German	
	0% speak a third language		
List countries in which they have worked	100% worked in native country	UAE, USA, UK, Canada	
	100% worked in UAE	<i>Part of participant selection</i>	
	66% worked in three countries	KSA, Egypt, Moldova, India	
	50% worked in four countries	Oman, Romania, Saudi Arabia	
List current job titles	Head, Senior Director, Director, Assistant Director		

Appendix K

Interview Preparation

Preparation

1. Prepare Informed Consent Form which includes the Participants Rights Form
2. Create and send interview Introduction Email/ Letter
3. Set up interview meetings with the participants that agreed to participant via the tracking sheet
4. Send the following to the participants at least one week before interviews:
 - a. Informed Consent Form (to be signed)
 - b. Interview questions and definitions
 - c. Demographic Questionnaire
5. Send reminder and confirmation request for scheduled interview agreement
6. Set up individual password protected file folders on researcher's computer
7. Set up individual code names for participants
8. Test two types of audio recording devices and ensure the file type is compatible with transcription service provider
9. Obtain the transcription service provider Non-Disclosure Agreement
10. Set up Dedoose, the coding software system
11. Set aside paper for note taking and potential images the participants may draw when describing systems thinking mental models

Interviews

12. Meet with participant at the scheduled time and collect the Informed Consent form and Demographic Questionnaire (if not already collected)
13. Ensure the meeting is conducted in a quiet environment to avoid interruptions
- 14. Ask for Permission to Turn ON the audio recordings**
15. Initiate the interview based on the researcher provided questions, while been aware to make the participant feel secure and comfortable in the process
16. Ensure the interview is conducted in the 60-minute time frame or within the time boundaries that were mutually agreed upon.
17. Ask participant to complete the Demographic Questionnaire
18. Finalize the interview and answer any remaining questions
19. Inform the participant that the recording will now be turned off.

After Interview

20. Set aside 30 minutes after the interview to write any personal observations regarding the interview environment, interview process, the participant's reactions, demeanor or any other observational notes.
21. Send a **Thank you email** to the participant and let them know that you are available for further discussion if there are any remaining questions or clarifications to be provided
22. Download the audio recordings and send to transcription services with coded names
23. Secure the audio recordings and transcriptions into the password protected files
24. Load the transcription into Dedoose

Coding and Analysis

25. Initiate coding analysis for each transcript and conduct iterative reviews of the data
 26. Identify two people in a doctoral studies program to code two interviews each and compare coding schemes with researcher's original coding schemes
 27. Conduct a skype call with the coders to review the comparative analysis and discuss if any coding scheme recommendations are required for adjustment
 28. Finalize coding and analysis through continual review of the first cycle coding and second cycle coding.
 29. Ensure monthly and/or periodic advisor meetings are scheduled to seek counsel to avoid researcher bias and assumptions
-

Focus Group

Preparation

1. Prepare Informed Consent Form which includes the Participants Rights Form
2. Create and send Focus Group Introduction Email Letter
3. Set up Focus Group meeting with the participants and appropriate venue
4. Send the following to the participants at least one week before interviews:
 - d. Informed Consent Form
 - e. Focus Group Session Overview and definitions
 - f. Demographic Questionnaire
5. Send reminder and confirmation request for scheduled Focus Group session
6. Set up individual password protected file folders on computers
7. Set up individual code names for participants
8. Finalize Focus Group session curriculum design
9. Set aside paper for note taking and the images the participants will draw and code when describing an ambiguous and uncertain situation and systems thinking mental model insights.

Focus Group Session

10. Meet with participant at the scheduled time and present an overview of the Focus Group session
11. Collect the Informed Consent form if not already collected
12. Ask participants to complete the Demographic Questionnaire
- 13. Ask for Permission to turn ON the recording**
14. Ensure the session is conducted in a quiet environment to avoid interruptions
15. Inform the focus group that recording will now be turned off.

After Focus Group Session

30. Set aside 30 minutes after the focus group to write any personal observations regarding the session environment, process, the participant's reactions, demeanor or any other observational notes.
 31. Send a Thank you email to the participant and let them know that you are available for further discussion if there are any remaining questions or clarifications to be provided
 32. Take pictures of the drawn images and secure the photos into the password protected file folder
 33. Analyze the findings of the Focus Group
 34. Analyze the findings in alignment with the Interview coding findings.
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Appendix L

Focus Group Systems Thinking Causal Maps

