2021

Change Sustainment Model (CSM) to Address Industry 4.0 in a Classified Environment

Hamilton Ervin
University of Central Florida

CHANGE SUSTAINMENT MODEL (CSM) TO ADDRESS INDUSTRY 4.0 IN A CLASSIFIED ENVIRONMENT

by

HAMILTON KAREEM-DISHAN ERVIN
Bachelor of Science in Industrial Engineering, University of Central Florida, 2017
Master of Science in Engineering Management, University of Central Florida, 2018

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Industrial Engineering and Management Systems
in the College of Engineering and Computer Science
at the University of Central Florida
Orlando, Florida

Fall Term
2021

Major Professor: Thomas O'Neal

ABSTRACT

Business and engineering have long intersected with each other in industry. In actuality, they are inseparable. That notion drove the thought process and actions taken to observe phenomena within a U.S. Fortune 500, Aerospace & Defense industry, Department of Defense, independent contractor. In Aerospace & Defense, the ability to implement technology freely and change to address an ever-evolving technological landscape in the world has proven to be difficult given the nature of the work performed. U.S. national security must be protected at all times, therefore information sharing guided by a "need-to-know" basis create an inability to easily implement organizational change company wide. The study focused on how to perform organizational change. Specifically, implementation of industry 4.0 techniques and technology within a classified organization given a shortened planning horizon and window of time to create change of two business quarters defined as 180-days. Through specific selection criteria three programs were chosen for observation and implementation of discovered necessary changes. Each program had their own respective size, nature, and type. Due to national security reasons, they will be defined for the purposes of this dissertation as Program A, the large program, Program B, the medium program, and program C, the small program. By developing, and then executing, a 10-step theoretical framework named the *Ervin Change Sustainment Model*, organizational change was sought after to introduce industry 4.0 techniques and technology to the major product line observed within the independent contractor.

This dissertation is dedicated to my momma, Jewel Antoniette Ervin, who raised me all by herself as a single mother. Your support and belief in me never wavered from the day I was born.

You truly are the real MVP.

ACKNOWLEDGMENTS

First and foremost, God, I love you. “God is our refuge and strength, an ever-present help in trouble.” – Psalms 46:1. You guided me at times when I did not believe in myself. This does not happen without you, and for that I am forever grateful.

To my momma, Jewel, thank you for believing in “this boy of yours” as Grandma Dot would say. You are my best friend, my rock, and the only person that believes in me 100% all the time. Giving you the world 10,000 times over would not express how much you mean to me. This Ph.D. is yours and I am just an extension. We did it, momma – I love you!

To my dad, Charles, thank you for your guidance and perspective on navigating a Ph.D. successfully. I love you, Dad.

To my mentors, Patricia Casey, Zachery Richardson, Quentin Hill, Mark Calabrese, Albert Bruton, Bertha Gant, Joseph Fornasiero, Thomas Lease, Dr. Germayne Graham, Dr. Gordon Chavis, Dr. Julie Salcedo, Dr. Stephanie Lackey, Dr. Charles Reilly, Dr. Jason Swanson, and Dr. Justin Boone, the guidance, perspective, and wisdom you all shared with me provided me the ability to accomplish this feat. Thank you all for everything.

To my support system, mainly Roslyn, Lashell, Asmita, and special others, you all are kind spirits and amazing individuals who continued to believe in me. Your kindness and care for me meant so much. Thank you for being there for me at all times.

To my dissertation committee chair, Dr. Thomas O’Neal, you took a chance on me when no one else would. Thank you for keeping me as a student and giving me the opportunity to prove myself.

To my dissertation committee members, Dr. Luis Rabelo, Dr. Ahmad Elshennawy, Dr. Kristin Horan, and Dr. Germayne Graham, thank you for your guidance, belief, and assistance. It meant more to me than you all will ever know.

To the McKnight Doctoral Fellowship, the work the organization does means so much to so many. Thank you for not only providing funding for me to pursue a doctorate degree at the University of Central Florida, but for creating a community for all the fellows.

To the University of Central Florida, you truly do stand for opportunity. Thank you for allowing me to pursue my bachelor's, master's, and doctorate degree here. You were my number one choice in high school, and words cannot express how thankful I am for the opportunity you provided to me. I love this university with all my heart. Go Knights, and Charge On!

Finally, to my future family, I love each and every one of you exactly how you are. I am extremely proud of you all. I pray that you regard this achievement, not as a burden you must live up to, but as an example that you too can accomplish anything you desire if you put your mind to it, your efforts towards it, and dedicate the necessary time.

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CHAPTER ONE: INTRODUCTION

Background of the Study

For centuries, necessity has long been the mother of innovation. In the 21st century, innovation has become the main talking point for companies in industries where transformation happens rapidly. Organizations face the constant threat of innovate or go bankrupt. In the age of who possesses the most information to make the best decisions, lacking in ability to analyze data to make sound business decisions can be detrimental to an organization. Over the past 10 years, companies such as Airbnb have disrupted the hospitality industry, Spotify has altered the music industry, and Facebook fueled the success of a new industry referred to as social networking. None of these companies are creative, which as defined by leading creativity researchers is, "showing qualities of originality and effectiveness" (Runco & Jaeger, 2012), these companies are innovative. By some, innovative has been defined as, "introducing a product, process, software, idea, concept, etc., considered new in the environment into which it is introduced" (Quintane, Casselman, Reiche, & Nylund, 2011). For organizations that are innovative, relying on organizational transformation is critical to success. Within classified environments, this phenomenon remains true, except with the caveat that information cannot be shared as freely as those outside of classified organizations. For organizations that do business in classified environments, which involves the use of classified information, organizational transformation has been, and still is, quite difficult to achieve post 9/11/2001.

Much in the world has changed since 9/11/2001. Technology has become easily accessible by many world-wide, information can be shared at a rate never before seen due to social media and the evolution of the internet, and the world has become smaller given the advanced capabilities of travel and long-distance communication via webcams, FaceTime, email,

and cell phones. Yet, in classified environments, an intelligence-sharing paradox exists where limited information distribution and extensive compartmentalization of information serve as impediments to information sharing (Maras, 2017). As one could imagine, information regarded as "classified" goes through a lot of scrutiny. The basic principles of "need to know", sensitive compartmented information (SCI), program access through extensive briefings to provide access to special access programs (SAP's), and polygraph, make classified information extremely protected. However, organizations that handle classified information need to be able to communicate with each other, derive business intelligence such as metrics to make decisions and take advantage of technology that exists today. This has yet to happen in full capacity due to existing organizational cultures within the intelligence community being resistant to change (Maras, 2017). Professor Hamilton Bean at the University of Colorado – Denver outlined that post 9/11/2001 both US intelligence officials and intelligence studies scholars claim that organizational culture is a cause of intelligence failure (Bean, 2009). In the same article, Bean goes on to elaborate that a potential remedy could be that the intelligence community develop information-sharing materials, provide information-sharing training, and share best practices across the intelligence community (Bean, 2009).

Department of Defense

Following the conclusion of World War II in 1945, President Harry Truman signed into law the National Security Act in 1947. That Act created the National Military Establishment under the Secretary of Defense. The act was amended in 1949 and included in the amendment was a change in title to Department of Defense. This then made the Department a part of the executive branch of the government, and therefore its head a member of the President's cabinet. This amendment aided in establishing what the Department of Defense was created to

accomplish. The mission of the Department of Defense is to provide the future security of the United States through the establishment of integrated policies and procedures for the departments, agencies, and functions of the government regarding national security (U.S. Congress, 1947). These functions are as follows:

1) To support and defend the Constitution of the United States against all enemies, foreign and domestic
2) To ensure, by timely and effective military action, the security of the United States
3) To uphold and advance the national policies and interest of the United States
4) To safeguard the internal security of the United States

(White, 1982)

Many years later after the National Security Act was signed, in 1982 President Ronald Reagan signed into effect executive order 12356 which outlined original classifications; derivative classifications; declassifications and downgrading; safeguarding; implementation and review; and general provisions (Executive Order 12356, 1982) regarding national security. Inside of that document, President Reagan had the following language included:

A. National Security Information (hereinafter "classified information") shall be classified at one of the following three levels:

(1) "Top Secret" shall be applied to information, the unauthorized disclosure of which reasonably could be expected to cause exceptionally grave damage to the national security.

(2) "Secret" shall be applied to information, the unauthorized disclosure of which reasonably could be expected to cause serious damage to the national security.

(3) "Confidential" shall be applied to information, the unauthorized disclosure of which reasonably could be expected to cause damage to the national security.

(Executive Order 12356, 1982)

As the Department of Defense grew, it needed to be able to contract out work for purposes of manufacturing, and research and development through DARPA (Defense Advanced Research Projects Agency). Organizations that do business in classified environments, or for classified customers (U.S. Army, U.S. Navy, U.S. Air Force, U.S. Marines, and U.S. Coast Guard), are known as Department of Defense, independent contractors.

Statement of the Problem

The Department of Defense, and their contractors, face a significant problem due to advances in technology. Post 9/11/2001, information-sharing and technology have come to drive how businesses operate and make sound decisions. Yet, the Department of Defense, and their contractors, have been unable to take advantage of this technology. A many of change models exist that assist organizations in adapting to the world around them, however, research shows that there is still room for improvement and the ability to create a new change model which focuses on issues that organizations primarily face in the 21st century. In a classified environment, specific processes are required to solve problems effectively and efficiently. Given the nature of classified environments, a many of common techniques that are known in the field of organizational development will not solve the problem effectively for classified organizations. Therefore, this dissertation will create, verify, and validate, specific processes to solve problems and implement new practices, new technology, and/or new organizational culture in classified environments through use of a newly founded change model. Leading to the ability for classified

organizations to take full advantage of what industry 4.0 has to offer in a matter in which national security will be protected.

Limitations of the Study

Given that this study took place in a professional environment where all participates were employees of the organization, limitation of time, funding, and access to participates had to be managed closely. In addition to those limitations, the timeline of completion for the study was defined by the host organization as two business quarters, or 180-days. Results were found in the beginning of the third business quarter from which the project began.

Major Assumptions

Assumption 1: Scope of project will not alter

Assumption 2: Timeline of project will not alter

Assumption 3: Access to resources will not alter

Assumption 4: Commitment of funding will not alter

Assumption 5: Location of study will not alter

Hypotheses

Hypothesis 1: The organization will show measurable change after two business quarters, or 180-days.

Hypothesis 2: The newly created change model leads to measurable change after two business quarters, or 180-days.

Research Question 1: How can an organization implement change that leads to measurable change after two business quarters, or 180-days?

Research Question 2: How can the newly created change model lead an organization to measurable change after two business quarters, or 180-days?

Measurable defined as positive increase or decrease in one or more organizationally defined metrics

Research Objectives

Before performing research to answer the problem statement, objectives were set to lead to a comprehensive answer. Those research objectives were the following:

1) Establish a new change model for primary use in classified organizations
2) Establish processes to implement new practices in classified environments
3) Establish processes to implement new technology in classified environments
4) Establish processes to implement new organizational culture in classified environments
5) Establish processes to collect, analyze, and report results in classified environments effectively
6) Establish processes to collect, analyze, and report results in classified environments efficiently

By verifying and validating these research objectives, creation of a new change model and pushing the start of the art further for the field of organizational development for classified environments was completed.

Potential Contributions

Some of the potential contributions that this dissertation will be able to provide are the following:

1) Provide classified organizations with a roadmap on how to improve efficiency
2) Provide classified organizations with a roadmap on how to improve effectiveness
3) Provide classified organizations with the ability to implement industry 4.0
4) Provide classified organizations with organizational change that can be sustained

By performing research within a classified organization, where the research focuses on classified organizations, the knowledge gained will come from a classified perspective. This will open the possibility for future research to be completed in this space. Leading to classified organizations being able to remain relevant, compete, and thrive in their industry. In addition, this research can lead to new discoveries in the field of organizational development, new ways to do business, and new areas to perform further research.

CHAPTER TWO: LITERATURE REVIEW

Keywords

Change Resistance. Classified Environment. Extrinsic Motivation. Industry 4.0. Intrinsic Motivation. Organizational Agility. Organizational Ambidexterity. Organizational Change. Organizational Change Models. Organizational Culture. Organizational Development. Organizational Flexibility. Organizational Innovation. Organizational Leadership. Organizational Sustainability. Organizational Transformation. Transactional Leadership. Transformational Leadership.

Organizational Development

To discuss organizational transformation, one must understand the overarching concept of organizational development. Multiple definitions exist from top researchers in the field, here are some below:

- Organizational development is a planned process of change in an organization's culture through the utilization of behavioral science technology, research, and theory.
  (Burke, 1982)
- Organizational development refers to a long-range effort to improve an organization's problem-solving capabilities and its ability to cope with changes in its external environment with the help of external or internal behavioral-scientist consultants, or change agents, as they are sometimes called.
  (French, 1969)
- Organizational development is an effort (1) planned, (2) organization-wide, and (3) managed from the top, to (4) increase organization effectiveness and health through (5)

planned interventions in the organization's "processes," using behavioral science knowledge.

(Beckhard, 1969)

- Organizational development is a systemwide process of data collection, diagnosis, action planning, intervention, and evaluation aimed at (1) enhancing congruence among organizational structure, process, strategy, people, and culture; (2) developing new and creative organizational solutions; and (3) developing the organization's self-renewing capacity. It occurs through the collaboration of organizational members working with a change agent using behavioral science theory, research, and technology.

  (Beer, 1980)

- Based on (1) a set of values, largely humanistic; (2) application of the behavioral sciences; and (3) open systems theory, organization development is a systemwide process of planned change aimed toward improving overall organization effectiveness by way of enhanced congruence of such key organization dimensions as external environment, mission, strategy, leadership, culture, structure, information and reward systems, and work policies and procedures.

  (Burke & Bradford, 2005)

- Organizational development is a systemwide application and transfer of behavioral science knowledge to the planned development improvement, and reinforcement of the strategies, structures, and processes that lead to organization effectiveness.

  (Cummings & Worley, 2009)

The definitions above provide keywords such as culture, effectiveness, strategy, etc., to emphasis that organizational development is the overarching theory that encompasses organizational

change, organizational culture, organizational transformation, and all aspects related to the organization with regards to development. In the Department of Defense, organizational development has proven to be more difficult compared to non-classified organizations due to the nature of the work, the existing organizational culture, and the limitations of information-sharing given the potential dangers to national security change could create. In 1991, Denison and Spreitzer summed up cultural orientations that can develop the basic understanding of what an organizations culture currently exists as. Those orientations are as follows:

- Group Culture
    - Has a primary concern with human relations. This culture emphasizes flexibility and maintains a primary focus on the internal organization. The purpose of organizations with emphases on the group culture tend to be group maintenance. Belonging, trust, and participation are core values, and primary motivational factors include attachment, cohesiveness, and membership. Leaders tend to be participative, considerate, and supportive, and they facilitate interaction through teamwork. Effective criteria include the development of human potential and member commitment.
- Developmental Culture
    - Emphasizes flexibility and change but maintains a primary focus on the external environment. This orientation emphasizes growth, resource acquisition, creativity, and adaptation to the external environment. Key motivating factors include growth, stimulation, creativity, and variety. Leaders tend to be entrepreneurial and idealistic, willing to take risks, and able to develop a vision of the future. In this culture, leaders also concentrate on acquiring additional

resources, and on attainting visibility, legitimacy, and external support. Effective criteria include growth, the development of new markets, resource acquisition.

- Rational Culture
    - Emphasizes productivity, performance, goal fulfillment, and achievement. The purpose of organizations with emphases on the rational culture tends to be the pursuit and attainment of well-defined objectives. Motivating factors include competition and the successful achievement of predetermined ends. Leaders tend to be directive, goal orientated, instrumental, and functional, and are constantly providing structure and encouraging productivity. Effectiveness criteria include planning, productivity, and efficiency.
- Hierarchical Culture
    - Emphasizes internal efficiency, uniformity, coordination, and evaluation. The focus is on the logic of the internal organization and the emphasis is on stability. The purpose of organizations with emphases on the hierarchical culture tends to be the execution of regulations. Motivating factors include security, order, rules, and regulations. Leaders tend to be conservative and cautious, paying close attention to technical matters. Effectiveness criteria include control, stability, and efficiency.

(Denison & Spreitzer, 1991)

Change Models

In capitalism, competition is encouraged. With capitalism, private ownership for profit, rather than state dictated control defines a “free-market” or “free-enterprise”. Because of this, businesses that operate in a capitalistic society face the constant threat of innovant or perish. As

capitalism is not new to the United States and has been the basis of the U.S. economy since the signing of the Declaration of Independence in 1776, businesses constantly seek ways to remain ahead of their competition. Techniques such as SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis, Balanced Scorecard, and Porter's Five Forces, just to name a few, are how these businesses determine where they exist in the market. A business consists of an organization, or organizations, that engage in commercial, industrial, or professional activities, either for-profit or non-for-profit (Hayes, 2020). A business may spend many resources to perform the techniques previously mentioned, or others, but executing the information that comes from those techniques require another step. That next step falls into organizational development. Specifically, organizational change. For this dissertation, the definition of organizational change used is, "Concurrent major changes in key organizational parameters, including strategy, structure, and the distribution of power" (Wischnevsky & Damanpour, 2006). Simplified to, modifying an enterprise's business processes to move an organization from an "as is" state to a "to be" state (MITRE, 2015). The main types of organizational change to be aware of that research and literature have focused on the most are the following:

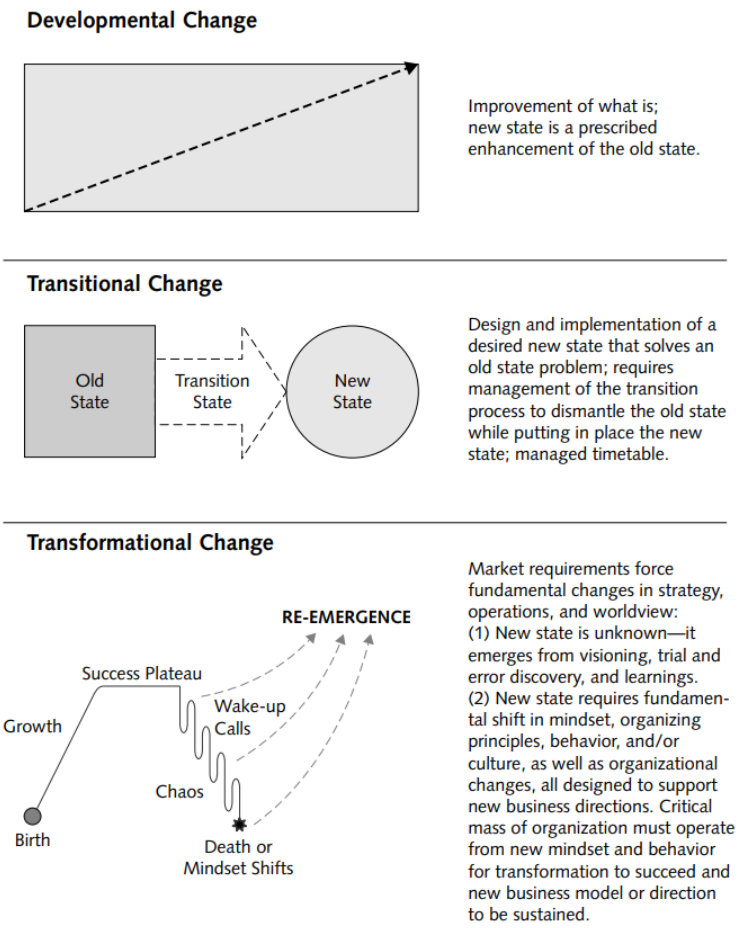

Figure 1: Model of the Three Types of Organizational Change

(Anderson & Anderson, 2010)

Given this understanding by researchers before the well-known Dr. Linda Ackerman Anderson presented it in text form, a many of researchers created unique organizational change models to ensure that businesses who use the techniques mentioned earlier in this section can actually execute change within their organization, or organizations.

Kurt Lewin introduced *Lewin's Model* back in 1946. This model has long been considered the basis for all models which have come after it. In *Lewin's Model* there are only three steps; (1) Unfreeze, (2) Act & Move, (3) Refreeze. As many can tell, this leaves a lot up to interpretation for the business to understand its organization and where it would like to be.

Which is good, however, as time went on organizations proved they needed more succinct direction to succeed in change. Models such as the *Judson Method*, the *Jick & Kanter Method*, the *Leading Change Method*, *Luecke's Method,* and the *Insurrection Method*, just to name a few, were created. Their breakdowns can be seen below.

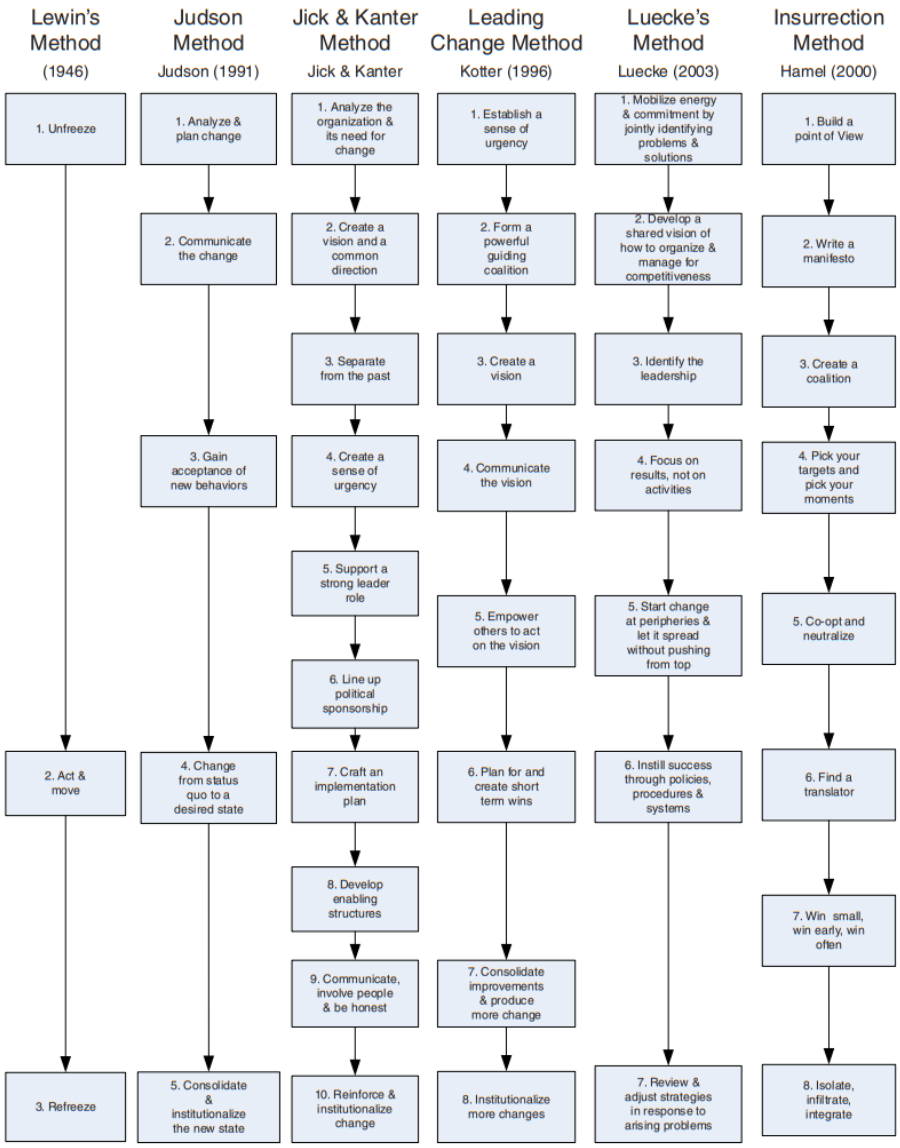

Figure 2: Change Management Methods

(Al-Haddad & Kotnour, 2015)

As seen in the chart above, each model goes about creating and sustaining change in a different way. Some focus on top-down implementation, some focus on bottoms-up implementation, and some focus on holistic middle integration. Top-down means gaining executive buy-in to ensure that the change can, and will, happen. Bottoms-up means creating an army of employees demanding the change, forcing executive leadership and management to listen. Holistic middle means providing a sense of urgency to the middle-management of the company to therefore push both up to executive leadership and down to the employee level. As discussed in the organizational development section of this literature review, understanding what type of culture exists within the organization determines the best way to go about creating and implementing change. In any given business, a different culture may exist in each of their organizations. Think a business that operates as an umbrella with multiple organizations underneath it. As an example, Northrop Grumman (the business) has an AS organization (Aerospace Systems), an IS organization (Innovation Systems), and a MS organization (Mission Systems), that create the single business entity. Each organization has a President who reports to the overarching CEO of the single business entity. Within each of those organizations, a different culture exists, and therefore, change cannot be executed the same way in each of the organizations.

Industry 4.0

For many organizations, yet alone classified organizations, industry 4.0 is the aimed for future state of intelligence. What is industry 4.0? As defined by industry expects, industry 4.0 is, "the next phase in the digitization of the manufacturing sector, driven by four disruptions: the astonishing rise in data volumes, computational power, and connectivity, especially new low-power wide-area networks; the emergence of analytics and business-intelligence capabilities;

new forms of human-machine interaction such as touch interfaces and augmented-reality systems; and improvements in transferring digital instructions to the physical world, such as advanced robotics and 3-D printing" (Baur & Wee, 2015). In classified organizations, engineering and manufacturing create the discriminating technology that allows for the warfighter to be in the best position to accomplish the mission successfully and with little to no damage taken. Because of that, department of defense contractor organizations must be able to execute manufacturing at the highest levels in the world. Leyh, Martin, and Schäffer explained that the manufacturing system that will come about because of industry 4.0 will rely on low-maintenance, self-adapting production systems as well as independent action based on own predictions and comparison with inventory data (Leyh, Martin, & Schäffer, 2017). That means creation of metrics and use of business-intelligence that will drive the decision making of organizations like those previously mentioned. The PricewaterhouseCooper (PwC) senior leadership team investigated and discovered that approximately $907 billion will be invested by companies across nine industries over a five-year period from 2018 to 2023 of that $907 billion, only $15 billion will be invested by the Aerospace and Defense industry, which is the lowest across the nine industries researched (PwC, 2016).

To successfully implement industry 4.0 practices into classified organizations, project management techniques and factors that have not been included in previous models for organizational development will be necessary. Professors Alper Camci and Timothy Kotnour discussed just this in *How to Manage Projects in Industry 4.0 Environment: Aligning Management Style with Complexity*, by stating, "…with the increased complexity as in the case of Industry 4.0, the project management approaches will need to become more agile, with shortened planning horizons and more involvement and communication with the stakeholders."

(Camci & Kotnour, 2019). In addition to those project management perspectives, factors such as the following are critical for the organization to begin the change necessary to implement industry 4.0 practices:

1) Understanding the team by personalizing both the impact and the resolution of the change coming. (Kislik, 2018)
2) Organizational readiness, which can be defined as resources and ability to change given the current state.

   (Al-Haddad & Kotnour, 2015)

Dr. Danny Miller, professor of strategy at McGill University and highly cited management researcher, feels that if there is almost no strategic planning being done, and the organization seems unfocused in its direction, then corrective action may be necessary to save the organization from becoming irrelevant (Miller, 1977). For an organization to have the awareness that innovation is necessary would be ideal. Many organizations do not have that awareness. Therefore, understanding the perspective of the organization, the employees of the organization, the leadership of the organization, and the market of the organization are critical to understand how an organization must position itself to remain relevant or exude control over a market. The ability to have the digital thread and digital twin give organizations access to metrics and live-time visibility of progress for making well-informed decisions regarding their business. As industry continues to push into industry 4.0 and technology becomes more capable, the implementation of the “digital thread” and the “digital twin”, will be more common than not. The United States Air Force published a Global Horizons final report in 2013 that provided detail to the intelligence community regarding the digital thread and digital twin; a portion of that report is as follows:

> "The concept of a digital thread/digital twin comprised of advanced modeling and simulation tools that link materials-design-processing-manufacturing (digital thread) will be the game-changer that provides the agility and tailorability needed for rapid development and deployment, while also reducing risk. State Awareness and System Prognosis advantages will be achieved through the Digital Twin, a virtual representation of the system as an integrated system of data, models, and analysis tools applied over the entire life cycle on a tail-number unique and operator-by-name basis. Modeling and simulation tools will optimize manufacturability, inspectability, and sustainability from the outset. Data captured from legacy and future systems will provide the basis for refined models that enable component and system-level prognostics. Archived digital descriptions of new systems would greatly facility any subsequent re-engineering required in the future. Human performance monitoring will enable adaption of systems to the "mission capable" state of the operator."
>
> (United States Air Force, 2013)

In that redacted presentation that the United States Air Force has released for public view, they also outlined some of the benefits that the digital thread and digital twin can bring to them. Some of those are, reduction in late discovery of system performance deficiencies; identification and management of technology maturation risks, quantification of risks at critical decision points; informed trade space exploration (design and manufacturing); and yield and rate improvements through agility of the shop floor (United States Air Force, 2013). Everything that these authors and the United States Air Force have discussed summarize what industry 4.0 can, and will, bring to organizations.

Transformation and Flexibility

Top consulting firm, McKinsey and Company argues that framework, road map, and guiding principles are three aspects that must be present at the CEO level to shepherd balanced, integrated change within an organization (Dichter, Gagnon, & Alexander). Organizations face a push and pull between management and employees that good organizational practices can facilitate into a relationship beneficial to all involved. Some factors discussed in the *Management Research Review* that make up good organizational practices are learning and training, reward system, involvement, and teamwork (Muduli, 2016). With these factors, leadership within an organization can rate how employees view the environment of the company. In turn, that also gives leadership the ability to rate management. With those ratings, leadership can focus on what managers are perceived to be lacking by employees on their team. If an organization can receive feedback from employees regarding managers, and provide managers trainings based upon their perceived shortfalls, then internal, strategic flexibility can begin to happen.

As discussed in a journal article in *The Academy of Management Executive*, "strategic flexibility is the organization's capability to identify major changes in the environment, quickly commit resources to new courses of action to those changes, and recognize and act promptly when it is time to halt or reverse existing resource commitments" (Shimizu & Hitt, 2004). For an organization to have such flexibility, a dependent factor of resource flexibility must be present within the organization as well (Singh, Singh, & Singh, 2013). If an organization does have strategic flexibility and the dependent factor of resource flexibility, then an organization has the presence of higher order capabilities (Aaker & Mascarenhas, 1984). Higher order capabilities provide an organization the ability to respond to highly turbulent environments where flexibility through implementation of new, fluid work systems can be put into action (Dunford et al., 2013).

Most recently, COVID-19 has made organizational implementation of new work systems essential to continue operating during the turbulent times the United States economy faces. However, COVID-19 was not planned and therefore adaptive approaches such as strategic flexibility prescribe avoiding prediction as much as possible in preference of possessing the capability to respond to change swiftly (Vecchiato, 2015). In less words, being able to effectively be reactive, while continuously being proactive.

Ambidexterity and Agility

The *Harvard Business Review* (HBR) claims in a study ran in 2004, 90% of ambidextrous organizations achieved their goals (O'Reilly & Tushman, 2016). In an article published in *The Academy of Management Perspectives,* organizational ambidexterity was defined as, "the ability of an organization to both explore and exploit--to compete in mature technologies and markets where efficiency, control, and incremental improvement are prized and to also compete in new technologies and markets where flexibility, autonomy, and experimentation are needed." (O'Reilly & Tushman, 2013). The authors of this article also walk the reader through the concept of achieving ambidexterity through three approaches: sequential, structural, and contextual. Sequential ambidexterity states, "firms can realign their structures to reflect changed environmental conditions or strategies" (O'Reilly & Tushman, 2013). Structural ambidexterity states, "separate structural units for exploration and exploitation but also different competencies, systems, incentives, processes, and cultures—each internally aligned" (O'Reilly & Tushman, 2013). Lastly, contextual ambidexterity states, "the behavioral capacity to simultaneously demonstrate alignment and adaptability across an entire business unit." (O'Reilly & Tushman, 2013). To break that down, sequential ambidexterity equivocates to macroeconomics. This allows the firm to realign globally to address the changed environment of the industry. At the highest

levels of leadership, this is needed to express to shareholders and employees that all will be well. Structural ambidexterity equivocates to microeconomics. This allows the firm to realign division by division, unit by unit, and then internally align. This allows for U.S. Fortune 500 aerospace and defenses corporations where each division under the corporate umbrella has a different purpose to align itself for the changes occurring in industry. Lastly, contextual ambidexterity crosses the previously two stated concepts. In most matrix organizations, this must happen. A CEO has control of the company but must align the multiple divisions through appointing a separate President (CEO of a division) to oversee each division. To accomplish firm ambidexterity, it must be discussed as a top-down planned strategic choice (Sinha, 2019). Implying that without strong, agile executive leadership, firm ambidexterity cannot be accomplished.

Being agile at the executive level for major organizations has long been an Achilles heel. Findings in a 2017 study publish to *Industrial and Commercial Training* showed that increased organizational agility increases the ability to respond proactively to unexpected environmental changes (Appelbaum et al., 2017). This is done through the employees within an organization. For change agility to thrive employees must be engaged, ready for new challenges, open to direction, generate ideas, learn, and feel vital to the success of the team (Appelbaum et al., 2017). Agility as being discussed here can happen through rapid absorptive capacity (RAC). This term can be defined as, "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends." (Mardi et al., 2018). While agility can be beneficial for an organization, sustainability of implemented change is critical to employee buy-in of the direction of the organization. The idea of "flavor of the month" direction from leadership cannot be present for organizations looking to make sustainable changes. Environmental management as it is referred to in peer-reviewed articles speaks to integrating environmental management processes within the

heart of the business model (Muja et al., 2014). This environmental management leads to sustainability that contributes to improved margins and increased revenue growth (Muja et al., 2014). That ultimately leads to greater shareholder return and potential opportunities for business growth inside and outside of the organization (Muja et al., 2014).

Innovation Culture

One way to define innovation is the introducing of a product, process, software, idea, concept, etc., considered new in the environment into which it is introduced (Quintane et al., 2011). Dr. Teresa Amabile, leading researcher in innovation, creativity, and motivation, and also professor at Harvard Business School, defines innovation as, "the successful implementation of creative ideas within an organization" (Amabile, 2015). Dr. Peter Drucker, renown management consultant and author, has been quoted as defining innovation as, "change that creates a new dimension of performance" (Hesselbein, Goldsmith, & Somerville, 2002). Barack Obama, 44th President of the United States of America, during a weekly address as sitting President titled *The American Spirit of Innovation*, defined innovation as, "the creation of something that improves the way we live our lives" (President Obama, 2016). These definitions from highly respected individuals span academia, corporate America, and even the public. All share the same sentiments, something creative that improves upon what currently exists. Most companies acknowledge that innovation allows for the organization to remain relevant. Over the year's companies such as Blockbuster, Toys R Us, BlackBerry, GameStop, and many others have either struggled or gone bankrupt due to lack of innovation. Competitors that enter the market bring fresh, innovative ideas to spaces that are already defined and established. Disruptors such as Netflix, Amazon, and Tesla have brought about change in industries where change does not typically happen. Or at least was perceived not to happen. While innovation is widely prescribed to as a means to improve

organizational performance, many firms do not, or cannot, properly develop it due to factors discussed throughout this paper (Liao et al., 2017). Three factors that have been argued as having heavy influence on innovation are the environmental context, the organizational context, and external and internal change agents (Steiber & Alänge, 2015). Those three factors make up a model of innovation discussed in an article published in the *Academy of Management Review* in 2008. The steps that drive that model of organizational innovation are motivation, invention, implementation, theorizing, and labeling (Birkinshaw, Hamel, & Mol, 2008). The main goal of this model, like most models regarding organizational innovation, is sustainment of the new management practices and organizational practices that have been implemented. Without a sustainment portion of a model for innovation, companies will revert to previous operation.

In an article published in *MIT Sloan Management Review* in 2006, four aspects to determine if organizational change was necessary, and how organizational change would happen if deemed necessary, were identified and studied regarding the management innovation process. Those four were, dissatisfaction with the status quo, inspiration from other sources, invention, and internal and external validation (Birkinshaw, Hamel, & Mol, 2008). With the first two aspects being in-place, an organization can acknowledge that change is necessary. With the second two aspects in-place principles on innovation can now be put into action. The invention phase discussed in the *MIT Sloan Management Review* article opens a world of research all by itself. A term that one will come across often when researching organizational innovation is intrapreneurship. As defined by the *Harvard Business Review* intrapreneurship is, "entrepreneurial creativity and innovation within large, established organizations" (Corbett, 2018). An argument can be made that organizational innovations are usually not produced by way of institutionalized research and development (R&D) processes but are the result of entrepreneurial employee behavior that breaks

customary business practice for the organization (Hecker, 2017). Companies such as Lockheed Martin created Skunk Works, Boeing created Phantom Works, and Amazon created Lab126 to house and support intrapreneurship by creating a subsidiary company to operate outside of the customary corporate umbrella. What this knowledge implies is that firms can remain innovative like small start-ups. Researchers have described the problem of remaining innovative as the Capability Rigidity Paradox. Dr. Leonard Barton, Emerita professor at Harvard Business School, described this paradox as, "where existing capabilities provide the basis for a firm's current competitive position, but without renewal, these same capabilities become rigidities constraining the firm's future ability to compete" (Leonard-Barton, 1992). To address this within large companies, corporate entrepreneurship, or intrapreneurship if you will, has become a major push for companies. Entrepreneurship requires established companies to strike a delicate balance between engaging in activities that use what they already know, while at the same time challenging themselves to embark upon new activities and opportunities to rejuvenate themselves in creation of new tactics to be innovative (Ahuja & Lampert, 2001). The biggest obstacles for firms to remain innovative while they scale are either their lack of motivation or their lack of ability (Henderson, 1993). No organization seeks to fail. Similarly, no organization seeks to have antiquated ideas that no longer keep market share.

In today's market, innovation is seen in direct relation with organizational performance. Organizations that put the time and funding into enhancing innovative ability are doing what some consider to be one of the most important levers to increasing profitability and growth within the organization for a competitive advantage (Dobni, Klassen, & Nelson, 2015). A study published in *Strategy & Leadership; Chicago* showed that the top six percent of organizations in both operating efficiency and revenue growth aligned innovation with business goals (Ikeda & Marshall, 2016).

That includes aspects such as industry expansion, product expansion and services expansion. While manufacturing innovation can be exploitative in nature (i.e. exploitative innovation), some in the field argue that innovation can be a repeatable process. The steps for repeatable innovation as defined in another study published in *Strategy & Leadership; Chicago* are (1) build the foundations of an innovative organization, (2) do the early work on innovation strategy, (3) optimize the value of an innovation portfolio, (4) increase innovation efficiency and speed, and (5) improve innovation profitability (Engel et al., 2015). In certain cases, having a systematic approach to innovation can be useful. Does that in-turn lead to creativity or simply follow a formula for the next iteration of product? Organizing creativity within organizations is still undefined by most. The argument made by some is that when people are given free rein to solve a problem, people tend to be uncreative, therefore arguing that constraints often stimulate creativity (Caniels & Rietzschel, 2015). One of the major constraints studied are threatening times. During threatening times, avoidance motivation can lead to creativity and innovation. During such times, creativity may be critical to innovation to keep up with demands on the market and competitors bringing new options to market (Roskes, 2015). Take into consideration what Netflix did to Blockbuster, Amazon did to Sears, and Apple did to BlackBerry. Organizations whose inability to innovate, caused by lack of creativity, have altered their position in the market negatively. While organizational innovation brings about changes that directly affect collaboration, routines, and allocation of resources, an organization must be willing to implement an innovation culture to see organizational innovation (Bertrand & Wald, 2018).

Transformational Leadership and Intrinsic Motivation

The occurrence of transformational leadership happens when a leader is charismatic, inspires followers, meets the emotional needs of the followers, and intellectually stimulates the

followers (Gashema & Gao, 2018). Within transformational leadership, the characteristics are not discrete. In many cases, the characteristics are emotional in nature and lean towards intrinsic theories that call for the leader to be adept at motivating individuals. As many researchers have discussed, the four interrelated dimensions of transformational leadership are idealized influence, inspirational motivation, intellectual stimulation, and individual consideration (Albert, Ibrahim, & Emmanuel, 2018). When employing idealized influence, leaders will facilitate forgiveness in an employee's wrongdoing, and suppress antisocial responses such as avoidance and revenge (Zdaniuk & Bobocel, 2015). Inspirational motivation requires leaders to utilize inspirational drive to gain employees' buy-in of a program or strategy and to push employees to realize that their work has larger implications than they may be aware of (Sahibzada, Kakakhel, & Khan, 2016). In turn, this pushes employees to support the goal of the leader by making their individual tasks seem monumental in contribution. When the employee feels that their contribution means something, intellectual stimulation happens, therefore empowering employees to want to follow the lead of the leader. That then entails that placing the incorrect leader into a position of leadership can have dangerous implications on organizational culture. As stated in the *Journal of Health and Human Services Administration*, "open communication and leader integrity will only empower followers if the leader is intellectually stimulating." (Smothers et al., 2016). Inferring that employees value intelligence in those they consider to be their leader. Lastly, the fourth dimension of transformational leadership; individual consideration. Within the dimension of individual consideration, the employee means more to the leader than just an individual that works for them, but a person they show high levels of concern and care for. According to the *International Journal of Information, Business and Management*," … individual consideration behaviour deals with developing subordinates in the way of coaching, teaching and providing

mentorship." (Oladela & Akeke, 2016). In short meaning that individual consideration allows the leader to cultivate the employees and in turn, the employees feel valued beyond their work.

Intrinsic motivation theory derives from the innate ability of individuals wanting to be useful. As stated in peer-reviewed articles, "this type of motivation arises within the individual on the basis of the will of the self without any compulsion from others." (Lee & Hidayat, 2018). Leadership, especially transformational leadership, requires a positive mental state of the leader, which trickles down to the employee. Leadership in and of itself is very important in the achievement of organizational goals since leaders are who set the goals of the organization (Lee & Hidayat, 2018). Another portion of related literature discusses the relationship between transformational leadership and work as being mediated by the satisfaction of the basic psychological needs for autonomy, competence, and relatedness (Jensen & Bro, 2018). Meaning that, employees must feel as if they are a part of the goal. Not only feel in a theoretical sense but see the results of the impact in the end deliverable item that the team produces. Employees also want to feel as if they are operating without being micromanaged. Again, furthering reinforcement of the psychological need for autonomy. In the work environment, the more autonomous an employee, the more competent the team, specifically the leader, views the employee to be. Because of that, some would argue that intrinsic motivation is a mediator while transformational leadership is a moderator (Wang, Kim, & Lee, 2016). That delicate balance allows for ideas to flow between members within the team, and members on other teams. Therefore, a platform is provided for cross-functional team engagement to exist with all ideas being heard and implemented as necessary by the group leader.

There are multiple levels of motivation that exist within transformational leadership, including the four dimensions of transformational leadership discussed earlier. However, given

those four dimensions, and other components that play a role in transformational leadership, the overarching pillar of transformational leadership is enjoyment. In readings published to the *Leadership & Organization Development Journal*, "... purely intrinsic motivation involves doing something purely for enjoyment, it may not be enough to elicit the individual to sacrifice their own interests for the group, which is a characteristic of highly transformational leaders. Instead, such a sacrifice may require that leader performance integrates with one's life goals and values and identify as the ethically responsible choice. In this regard transformational leadership may require an autonomous form of regulation that amounts not only to personal enjoyment, but also to a moral responsibility to be an effective leader." (Gilbert, Horsman, & Kelloway, 2016). That portion of their peer-reviewed article speaks directly to what must be considered for organizational change if the organization looks to seek transformational leadership. Employees that view what they do as a passion and not a job allows room for a transformational leader to engage employees at a deeper level as the transformational leader is in-place to act as a mentor and coach of his/her followers; therefore, aiding them in the generation of creative solutions for diverse problems (Gashema & Gao, 2018). Overall, the four components of transformational leadership, as well as the theories addressed in intrinsic motivation, drive the idea home that to be transformational in nature as a leader one must show attributes across multiple functions of human cognition. All of which come back to trust the employee has in the leader and the care the leader has for the employee.

Transactional Leadership and Extrinsic Motivation

The occurrence of transactional leadership happens daily for organizations. In fact, many will argue that it is a necessary component of leadership. In transactional leadership, leaders, and followers exchange gratifications in terms of work to be completed and the amount of

compensation that will be received for completion of work (Martin, 2015). Transactional leadership holds its base as the basis of compensation within organizations. Complete X number of hours working receive Y amount of compensation. Complete X+A number of hours working receive Y+B amount of compensation with overtime. Everything has a contractual understanding between the leader and the employee. An issue with transactional leadership is that it is not sufficient for creating significant change within an organization or inspiring achievement of individuals at higher levels (Martin, 2015). In fact, transactional leadership has been used mainly as a tool to predict outcomes under uncertain social contexts when accompanied by organizational financial and nonfinancial rewards (Xifang & Jiang, 2018). These rewards can include bonuses and other perks such as tickets to local sporting events and invitations to company congratulations events. With such a reward-based system, creativity and innovation are stifled in cases when the reward is not compelling enough for the end goal that has been clearly defined. The findings of a study in the *African Journal of Economic and Management Studies* suggests, "work-related flow increases as innovative learning climate increases through the application of transactional leadership styles" (Aminu & Nana, 2017). This finding implies that transactional leadership creativity and innovation can be artificially manufactured through rewards. Leading the conversation into a discussion of extrinsic motivation and exploitative innovation. Those two ideas drive the success of transactional leadership and allow for the concept to remain relevant as its own entity.

At its simplest form, extrinsic motivation is used to entice employees (Turner, 2017). The concept of extrinsic motivation has been filtered out of company culture to aid in the preferred use of intrinsic motivation. To do this companies have moved the extrinsic value of their organization to the offer phase for potential employees. As stated in the *International Journal of*

Behavioural and Healthcare Research, "the concept of motivation has become more important and valued than ever before with the modern economy and heavy competition between companies…." (Jaffar & Kappagomtula, 2016). Organizations have concluded that attracting top talent does not strictly rely on what the company does, but what the company can offer. In a sense, organizations have accepted that attracting talent, specifically that of which in the millennial pool, will be much more extrinsic in nature than intrinsic in nature. Unlike past generations where extrinsic motivation led to workplace incentives and job security, as well as enhanced well-being and value with an organization (Brooks & Fenner, 2018), the millennial generation is driven by salary increase, accountability and working conditions (Saeed et al., 2018). Implying that to keep millennials motivated and loyal, early promotions, aesthetically pleasing working environments, and responsibility are important factors.

In a study published to the *Frontiers in Psychology* journal, findings showed that the higher the perceived probability of receiving relational rewards and the higher the intrinsic motivation, the greater the positive effect on creative/innovative outcomes (Fischer, Malycha, & Schafmann, 2019). Furthermore, the authors go on to describe the need for organizations to create a win-win situation by enhancing organizational innovativeness and considering their employees' needs (Fischer, Malycha, & Schafmann, 2019). This ideology lines up with the beliefs shared in the *Industrial and Organizational Psychology Journal at Bowling Green*, which states, "Strategies should include providing meaningful career development opportunities, recognizing employee efforts in public ways, and helping employees understand why they are part of a winning team through a strong value proposition." (Delaney & Royal, 2017). Confirming that extrinsic and intrinsic motivation must be synchronized to provide leaders the ability to engage employees.

Overall, motivation is multifaceted, dynamic, and context-dependent (McGee, 2016). Therefore, understanding that no two employees are the same is critical to the success of the leader. Effective communication with employees to understand what does motivate each individual employee allows the leader to build performance goals for the employee to succeed both for intrinsic and extrinsic reasons.

Psychology of Transformation

Change in and of itself is coupled with resistance. Handling change throughout an organization must be met with effective communication. This factor has been recognized as a relevant dimension to the success of organizational transformation, and is considered important in building transformation readiness, reducing uncertainty, and as a key factor in gaining commitment from employees (Matos & Esposito, 2014). The uncertainty of change has been studied by multiple researchers and the common reasons that researchers agree upon for why people exhibit resistance to change are: the desire not to lose something that has a certain value; misunderstanding change and its implications; belief that change does not make sense for the organization; and a low tolerance for change (Fuioaga & Rusu, 2018). It has also been discussed that to overcome the resistance to change, education and communication; participation and involvement; facilitation and support; negotiation and consent; manipulation and co-optation; implicit or explicit coercion are useful in minimizing the organizational resistance of individuals (Fuioaga & Rusu, 2018). Inferring that change of which ignoring those being directly affected will be resisted by those being affected (Nadim & Singh, 2019). Therefore, a deep understanding of how change will affect the organization overall is critical and will drive whether the change can be sustained or not.

The literature regarding the psychology of transformation also shows that workplace psychology is crucial to motivate positive employee behavior and performance. Dr. Edward Deci and Dr. Richard Ryan, well-known professors of psychology at the University of Rochester, defined motivation as, "the processes that initiate behaviour, or what moves people to act" (Deci & Ryan, 2008). In the workplace psychology literature, especially that of which focuses on leadership, examines how leaders can motivative in various ways. Through a theory referred to as Self-Determination Theory, we know that there are three prominent needs for optimal motivation. Those prominent needs are competence, autonomy, and relatedness (Ryan & Deci, 2000). Dr. Bobby Hoffman of the University of Central Florida stated in his book, *Motivation for Learning and Performance*, breaks the three needs described by Deci and Ryan down in detail.

> "Competency implies that individuals are energized through self-assessments and self-reflections of their personal capabilities and are confident in their own knowledge and abilities. In order to meet the need of competence, individuals must also perceive the ability to exercise free will, or autonomy, in order to demonstrate their competence. Demonstrating autonomy allows free expression of behaviors as a means for the individual to feel self-determined and not controlled by the context of their efforts. Relatedness is the tendency to seek external validation or recognition from others as the person exhibits competence by exercising autonomy."
>
> (Hoffman, 2015)

In addition to this knowledge on Self-Determination Theory, we also currently know that motivation exists on a continuum, which makes understanding intrinsic and extrinsic motivation in the workplace a bit easier. Amotivation does not involve any intentional activity or motivation whatsoever, and thus lies on the far-left end of the continuum (Gilbert, Horsman, & Kelloway,

2016). Implying that amotivation is uncontrollable. Lastly, extrinsic motivation fills the in-between of the continuum from amotivation to intrinsic motivation. Extrinsic motivation is believed to be necessary when a task is not inherently interesting to the individual, so external contingencies like rewards and punishments are necessary for motivation (Gilbert, Horsman, & Kelloway, 2016). Given that background, to shortly answer the question in a few sentences, yes, I believe one type of motivation is more important than the other. Intrinsic motivation is more important for innovative culture and organizational transformation than extrinsic motivation. Dr. Teresa Amabile, leading researcher in innovation, creativity, and motivation, and also professor at Harvard Business School, wrote, "A primarily intrinsic motivation to engage in an activity will enhance creativity, and a primarily extrinsic motivation will undermine it." (Amabile, 1996).

To understand the psychology of transformation deeply, one must also analyze the societal and general shifts that can, and are, impacting organizations. Millennials and Generation Z will be the workforce in a few years as Baby Boomers retire, and Generation X moves fully into executive leadership positions and/or retire. Millennials are on track to account for over half of the U.S. workforce within the next decade (Pew Research Center, 2010). Millennials have been shaped by helicopter parenting (meaning overprotective and excessive interest), frequent positive feedback and reassurance, significant leaps in technology, and political and economic turmoil (Thompson and Gregory, 2012). Millennials are also highly prone to switching jobs or careers, and per the statistics, nearly 60% of employed Millennials have changed jobs at least once already in their careers (Rosentiel, 2010). The age range of the millennial generation (officially known as Generation Y), ranges from 1981-1996 (Dimock, 2019). Organizations will have to innovate internally before succeeding at innovating externally and organizations must change their value proposition to retain millennials. It is no secret that Millennials love to be involved with

organizations who have a cause and provide them with the potential to do good in society. Mark Cuban, tech industry billionaire and owner of the NBA's Dallas Mavericks, has stated that, "Millennials want to market their careers every month and try to figure out their worth to themselves, their companies and society." (Cuban, 2014). Per the literature, that statement implies that personal and cultural values of Millennials will heavily shape the process of innovation within an organization. One guiding belief of organizational transformation as discussed in an article published in the *Academy of Management Executive* stated, "All participants are capable of being trusted in a co-creative endeavor and are important, equal stakeholders." (Jassawalla & Sashittal, 2002). Intrinsically, the multiple research outlets show that Millennials value a sense of belongness. In simpler words, Millennials want to be team players whose opinion is valued on the team and within the organization (Acar, 2014). Transformative leadership critiques inequitable practices and offers promises not only of greater individual achievement but of a better life lived in common with others (Shields, 2010). Therefore, the process of innovation finds itself being shaped by all aspects of the organization; both internal and external. Employees, especially those of the Millennial age will need a sense of belongness combined with a transformative leader fighting to knock down the mindset set in by Baby Boomers and Generation X. Baby Boomers placed emphasis on loyalty, work ethic and a steady career path; Generation X placed emphasis on work-life balance, individual advancement, stability and job satisfaction; however, Millennials place emphasis on meaningful work, creative outlet, and personal fulfilment (Cattermole, 2018). Without an organization adjusting their value proposition, attracting, and retaining, Millennials will be quite difficult. Organizations need Millennials as the Millennial generation is known for their technological sophistication (Fernandez, 2009). In a world where technology is the future,

without Millennials organizations are doomed to not being able to compete or remain relevant in their market.

Gap Analysis

While performing the literature review, there were noticeable gaps that exist between the knowledge known in the field as a whole and the application of that knowledge implemented in the field today. One major gap has to do with organization development, which as discussed throughout this dissertation, is the overarching concept that includes all aspects related to the development of the organization. Today, the generational shift from baby boomers and generation X to millennials and generation Z are influencing organizational cultures and how organizational transformation must be executed. Quinn and Kimberly discussed organizational culture back in 1984 by stating, "explore the deep structures of organizational culture, the basic assumptions that are made about such things as the means to compliance, motives, leadership, decision making, effectiveness, values, and organizational forms" (Quinn & Kimberly, 1984). Yet, as recent as 2015, Al-Haddad and Kotnour discussed understanding the human side of change as necessary for future models (Al-Haddad & Kotnour, 2015), and as of 2017, Maras discussed organizational cultures serving as barriers to information sharing (Maras, 2017). This implies that the gap of organizational culture alters as generational shifts occur. Organizational culture is the foundation of any organizational change, including transformation, that can take place within an organization. Therefore, addressing the knowledge in the field of organizational development with respect to organizational culture must take place on a relatively regular basis, so that organizations do not fall behind the times due to lack of relevant knowledge. It cannot be stressed enough that the problems of today are much different than the problems of 10 years ago or more.

Famed organizational development researcher and professor at Auburn University, Dr. Achilles Armenakis has amassed over 19,000 accredited citations in his tenure, specifically in this field. In 2015, he wrote an article titled, *Organizational Change: A Focus on Ethical Cultures and Mindfulness*. In this article, he discusses the concept of building and maintaining ethical cultures. Mainly that many organizations have entrenched practices which are deeply unethical and to his belief, not much has changed with regards to this since the 2008 financial crisis (Armenakis & Burnes, 2015). Dr. Armenakis also goes on to state the following:

> "The change field is ripe for the development of additional quantitative methodologies to diagnose organizational culture, as well as qualitative cases to assess ethical organizational cultures."
>
> (Armenakis & Burnes, 2015)

In addition to those gaps, the well-known change models in the field of organizational development that many refer to were created over a decade ago. Major players such as Achilles Armenakis, Timothy Galpin, Gary Hamel, Todd Jick, Arnold Judson, Rosabeth Kanter, Timothy Kotnour, John Kotter, Kurt Lewin, and Richard Luecke, just to name a few, have created and discussed organizational development for years, yet many companies are still searching for answers on how to implement technology that the world has never seen before into cultures that are still not known to be ideal. In an age where technology such as talking devices, which includes connected sensors to provide data, is twice that of the human population (Butler, 2016), change models that rely on management techniques from the past do not give organizations the ability to address the problems of today. Which in turn can hurt their tomorrow. The gaps that exist in the field of organizational development are not tremendous holes that cannot be overcome, but they are opportunities to expand the knowledge of the field for problems that exist today. This is the

true beauty of research in a field such as organizational development. As time continues, new problems will come about that require new, innovate ways to solve them and create new opportunities for organizations to succeed and compete in their respective markets.

Literature Review Conclusion

All the information presented in this literature review was gathered through both the traditional literature review method and the systematic literature review method.

With the traditional literature review method, information is gathered through free search without much exclusion criteria (Keathley, 2019). While doing the traditional literature review method, the main engine used was Google Scholar. Through Google Scholar, identifying literature that would be more relevant in the commercial world was the aim. Therefore, reviewing documents published to outlets such as the *Harvard Business Review*, *MIT Sloan Management Review*, information presented by companies, and knowledge shared by both industry and political leaders, gave this literature review information relevant in industry settings.

On the other hand. with the systematic literature review method, information was gathered through an iterative PRISMA protocol process that focuses on identification, level one screening, level two screening, and finally, what was included in the review. For this, the main search engine used was ABI/INFORM ProQuest. With this engine, applying exclusion criteria, using Boolean phrases, applying plurals, applying dates, applying peer reviewed only, and applying scholarly journals only was quite simple. By performing the systematic literature review, the results are summarized in a manner that would be replicable in the future for research purposes. See results on next page:

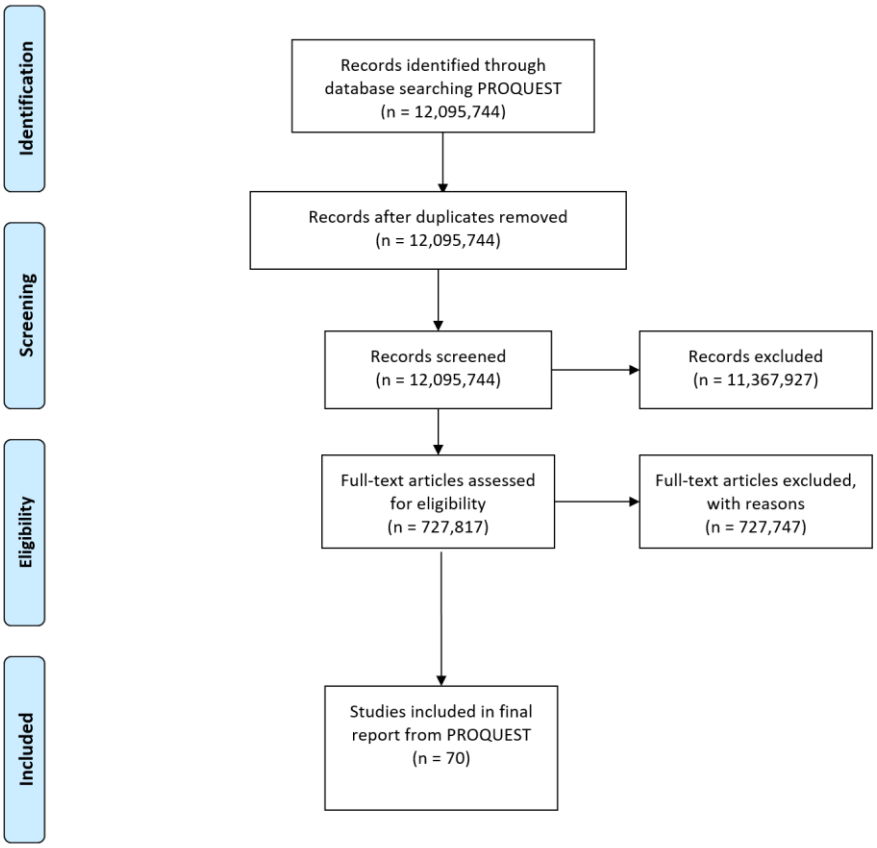

Figure 3: PRISMA Protocol Results for ABI/INFORM Proquest

(Moher, Liberati, Tetzlaff, & Altman, 2009)

By not limiting this literature review to just one methodology of analyzing results this dissertation has aspects relevant to both commercial industry and academia. Like the research itself, which can be used in both commercial industry and academia, it has a strong connection to both simultaneously, therefore providing more defensibility of knowledge.

CHAPTER THREE: METHODOLOGY

Overview of Methodology Chapter

The theoretical framework provided in this chapter outlines a newly created change sustainment derived from identified gaps in the research and personal experience as a top-secret engineer having worked for Department of Defense contractors. As noted in the research completed by highly cited authors, there exists room to create a new change sustainment model due to the ever-evolving state of businesses and their internal organizations. Some of the attributing factors as identified by these highly cited authors are organizational culture, information-sharing, generational shifts, and advances in technology (Al-Haddad & Kotnour, 2015; Maras, 2017; Armenakis & Burnes, 2015; and Butler, 2016). In addition to these factors, personal experience as a top-secret engineer working for Department of Defense contractors as a systems engineer, project engineer, and operations manager has provided me firsthand insight on this topic to see where real-world problems exist in the day-to-to workings of Department of Defense contractors. With this, research, combined with years of experience, led to the creation of this dissertation research which focuses on answering the following questions:

- How can positive measurable change be created in 180-days within a classified environment?
    - If not, what positive measurable change, if any, can be created in 180-days within a classified environment?
- How can a new organizational culture be successfully implemented in 180-days within a classified environment?
- What factors contribute to an organizational culture leading to innovation within a classified environment?

- How can industry 4.0 technology be successfully implemented in 180-days within a classified environment?

These questions will be answered through both qualitative and quantitative methods to provide a full story of how businesses can address industry 4.0 within their organizations. By using qualitative and quantitative methods, this dissertation was able to provide insight on "how" and "what" questions, as well as provide statistical and practical validation. The theoretical framework, and purpose of this dissertation, was to show that this model can serve for implementation of anything defined as "new" to a group within an organization. Therefore, the case study to be discussed in this chapter served as an example of how the *Ervin Change Sustainment Model* can work within a classified organization.

Research Process

Conveying the process of thoughts can be quite difficult. To assist in seeing the process of how the research for this dissertation was conducted a flow-diagram was created to identify critical steps in the process of dissertation research. See diagram below (beginning from bottom, ending at top):

Figure 4: Dissertation Research Process

This flow-diagram provides insight on the breakdown of chapter one, chapter two, chapter three, chapter four, and chapter five of this dissertation. The timeline in which this process happened

spanned the duration of the doctoral program. While navigating through the design of the research model, understanding that data can be quantitative (numerical) or qualitative (point of view based) was the foundation of how to go about designing the research model.

Research Paradigms

A many of research paradigms exist that could be discussed at length. However, for the purposes of this dissertation, the focus will be on three paradigms that are relevant to the research being performed. Those are (1) positivism research paradigm, (2) interpretative research paradigm, and (3) action research paradigm. Before describing those paradigms in detail, the overarching definition used of a research paradigm in general is as follows:

> "A research paradigm is a network of coherent ideas about the nature of the world and of the functions of researchers which, adhered to by a group of researchers, conditions the patterns of their thinking and underpins their research actions."
>
> (Bassey, 1999)

Positivism and interpretivism can be discussed as opposites, if you will, due to their ontology and epistemology. Understanding philosophy, of which is documented, goes as far back as Plato and Socrates during ancient Greek times. Ontology is the study of what there is (Hofweber, 2020). Epistemology is the study of what it is to know (Steup, 2020). In layman terms, ontology deals with nature of existence, allowing for the separation of person and reality. Epistemology deals with knowledge as a discrete function, allowing for the inseparability of person and reality. On the next page, a detailed breakdown of the two paradigms provides more insight.

Metatheoretical Assumptions About	Positivism	Interpretivism
Ontology	Person (researcher) and reality are separate.	Person (researcher) and reality are inseparable (life-world).
Epistemology	Objective reality exists beyond the human mind.	Knowledge of the world is intentionally constituted through a person's lived experience.
Research Object	Research object has inherent qualities that exist independently of the researcher.	Research object is interpreted in light of meaning structure of person's (researcher's) lived experience.
Method	Statistics, content analysis.	Hermeneutics, phenomenology, etc.
Theory of Truth	Correspondence theory of truth: one-to-one mapping between research statements and reality.	Truth as intentional fulfillment: interpretations of research object match lived experience of object.
Validity	Certainty: data truly measures reality.	Defensible knowledge claims.
Reliability	Replicability: research results can be reproduced.	Interpretive awareness: researchers recognize and address implications of their subjectivity.

Figure 5: Differences between Positivism and Interpretivism

(Weber, 2004)

Positivism relies on scientific method for development of general abstract laws describing and predicting patterns in the physical world in which theory is established deductively through formal statistical testing of hypotheses (Weaver & Olson, 2006). Based on this, the positivism research paradigm aligns strongly with quantitative research. On the other hand, interpretivism relies on understanding phenomena that are studied through the eyes of people in their lived situations (Weaver & Olson, 2006). Based on this, the interpretivism research paradigm aligns strongly with qualitative research.

Lastly, the action research paradigm. Kurt Lewin, famed psychologist who developed the original change model of which change models today are based off also developed the action research paradigm. In 1946, Lewin characterized action research as the following:

> "A comparative research on the conditions and effects of various forms of social action and research leading to social action."
>
> (Lewin, 1946)

Lewin's action research paradigm follows a four-step framework which consists of (1) planning, (2) acting, (3) observing, and (4) reflecting (Lewin, 1946). Lewin, being the psychologist he was, believed in reflection to understand why what is happening is happening. Reason and Bradbury stated the following:

> "In action research, knowledge is a living, evolving process of coming to know rooted in everyday experience; it is a verb rather than a noun. This means action research cannot be programmatic and cannot be defined in terms of hard and fast methods, but is a work of art."
>
> (Reason & Bradbury, 2001)

Based on this, the action research paradigm aligns with both quantitative and qualitative research to therefore allow for all perspectives, reasons, data, and information to be considered. Action research is just that, built to develop action that can be taken to improve a current situation.

Understanding Case Study Research

In a qualitative case study of this nature, one must understand that it is a research methodology that helps explore phenomenon within some particular context through various data sources (Rashid et. al, 2019). There are four design types that case studies can fall under, (1) holistic single-case design, (2) holistic multiple-case design, (3) embedded single-case design, and (4) embedded multiple-case design. See depiction on next page.

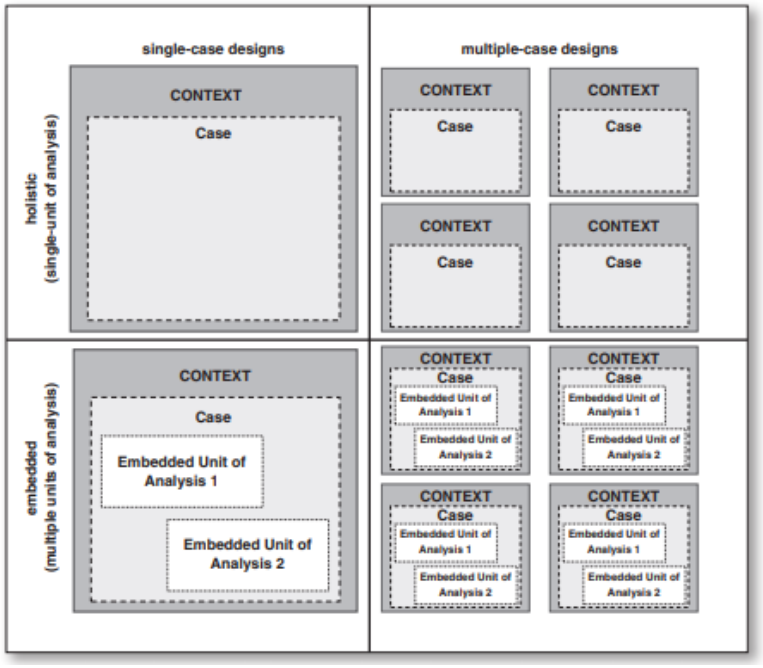

Figure 6: Basic Types of Designs for Case Studies

(Yin, 2011)

This dissertation was a holistic single-case design, and thus followed the direction of how to perform case study research designed by Dr. Robert Yin, Dr. Barney Glaser, and Dr. Anselm Strauss. He will be discussed later in this section. For the case study research in this dissertation, a mix of both quantitative and qualitative methods will be necessary to appropriately make conclusions about the hypotheses outlined in chapter one and later in this chapter. Leedy and Ormond simplified quantitative and qualitative research by creating a comparison table; see on next page:

Table 1: Comparing Quantitative and Qualitative Research

Characteristic	Quantitative	Qualitative
Purpose	• Explaining and predicting certain phenomena • Establishing and confirming relationships	• Understanding and describing complex situations • Building theory from explanatory and interpretative situations
Process	• Defined variables • Objective and detached view • Fixed design	• Interpretative data • Subjective and personal view • Flexible design
Data collection	• Large representative sample • Standard instruments that converts data to numerical values	• Small informative sample • Observation and interviews
Data analysis	Empirical and rational	Inductive and explanatory
Results reporting	Formal and scientific Numbers and statistical values	Informal and literary style Words and narrative information

(Leedy & Ormond, 2001)

The differences of quantitative and qualitative are stark, yet they balance each other out by providing analysis from two perspectives on the same topic. Using complementary methods is generally thought to lead to more valid results, and in the case of quantitative and qualitative, viewing them as complementary rather than as rivals provides benefits to research (Jick, 1979). Given this information, the research performed for this dissertation used both quantitative and qualitative approaches that cross the information in the table provide above.

Dr. Kathleen Eisenhardt is one of four highly cited professors in the field of case study research. The definition she uses of a case study is, “a research strategy which focuses on understanding the dynamics present within single setting.” (Eisenhardt, 1989). Her approach is an inductive research method that follows a process that she created and tested. In her approach she focuses on developing theory after the research has begun to allow for non-constricting thought. With Eisenhardt’s approach, shaping hypotheses and enfolding literature are two of the last three steps of her eight-step process (Eisenhardt, 1989). The limiting factor that led me away from performing case study research using Eisenhardt’s approach is that it relies too much on observation without an aimed for end goal to start the research.

Dr. Barney Glaser and Dr. Anselm Strauss are two of four highly cited professors in the field of case study research. Their approach, known as *Grounded Theory*, developed its roots in sociology. Similar to Eisenhardt, *Grounded Theory* is an inductive form of research. Their defined process can be seen below.

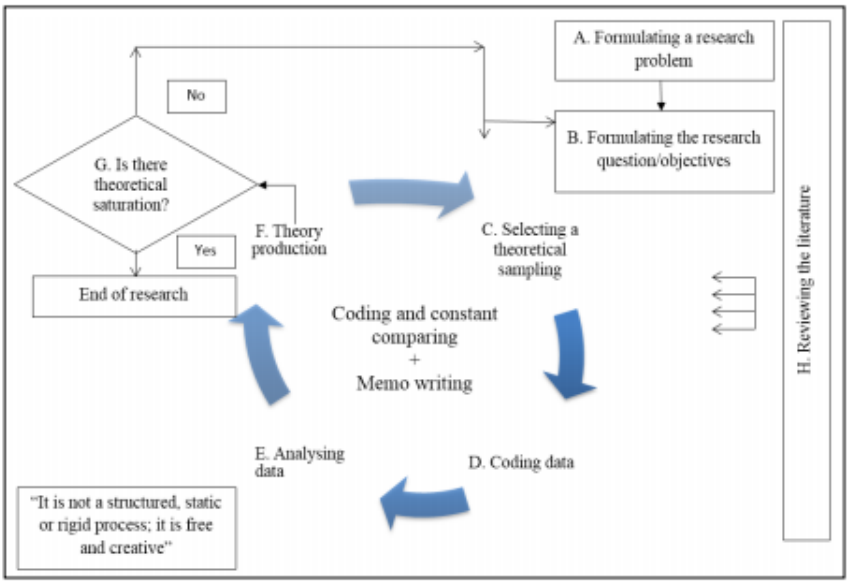

Figure 7: Grounded Theory Study Design

(Navarro, & Montoya-Restrepo, 2016)

In their initial publication of grounded theory in 1967, Glaser and Strauss stated, "Our basic position is that generating grounded theory is a way of arriving at theory suited to its supposed uses." (Glaser & Strauss, 1967). Researchers who perform case study research have used *Grounded Theory* since its inception due to the methods used to perform the research and how conclusions are therefore drawn. Methods in *Grounded Theory* include, (1) coding data, (2) developing, checking and integrating theoretical categories, and (3) writing analytical narratives throughout inquiry (Charmaz & Belgrave, 2007). Sources of data in *Grounded Theory* are (1) interviews, (2) field observations, (3) historical accounts, (4) quantitative data, and (5) qualitative data (Strauss & Corbin, 1994). Since *Grounded Theory* is inductive, no theoretical framework, or

extensive literature review, is done before the start of the case study. In fact, Glaser and Strauss argue that any literature read before beginning the case study should be that tied to other fields, and not directly tied to the field in which the case study research is being performed (Glaser & Strauss, 1967). In the initial publication of *Grounded Theory*, Glaser and Strauss took a position on quantitative and qualitative methods that for the purposes of this dissertation will be considered true.

> "There is no fundamental clash between the purposes and capacities of qualitative and quantitative methods of data. What clash there is concerns the primacy of emphasis on verification of generation of theory."
>
> (Glaser & Strauss, 1967)

As discussed early by Reason and Bradbury, research of this kind is an art, and therefore cannot be programmatic and cannot be defined in terms of hard and fast methods (Reason & Bradbury, 2001). The limiting factor that led me away from using *Grounded* Theory exactly as proposed by Glaser and Strauss is that it too relies too much on observation without an aimed for end goal to start the research. However, the factor that contributed to me using aspects of *Grounded Theory* for this research is its strength in understanding that quantitative and qualitative data have no fundamental clash with regards to verifying theory (Glaser & Strauss, 1967). The methods used in *Grounded Theory* allow for a researcher to mix methods successfully to perform research of the case study variety.

Dr. Robert Yin is one of four highly cited professors in the field of case study research. I decided to focus on Yin last as much of his recommended case study research methods were used for the development of this dissertation. Yin defines a case study as, "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the

boundaries between phenomenon and context are not clearly evident" (Yin, 1994). With Yin, the contrast between his approach, and the approaches of Eisenhardt, Glaser, and Strauss, are stark. Yin's approach is not inductive. In fact, Yin states, "An important step is the development of a rich, theoretical framework" (Yin, 1994). With Yin's approach, going into the case study having done an extensive literature review and developing a framework are critical before beginning the research.

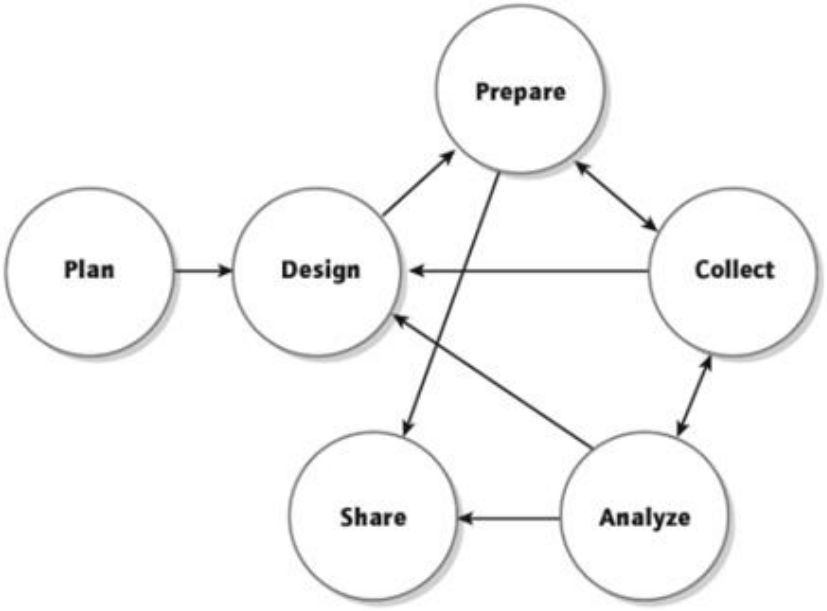

Figure 8: Doing Case Study Research

(Yin, 2017)

As seen above, throughout the case study research, coming back to enhance the design is commonplace. As the research is happening, information can be shared to allow for findings to drive how to proceed. This iterative process creates a strong design. There are no limiting factors that led me away from using Yin's approach to case study research. The factors that contributed to me using many of the aspects of Yin's approach were (1) in engineering organizations, having a plan and initial design is a must, (2) extensive literature review before beginning the case study

allows a researcher to know the current state of the field, and (3) Yin provides a detailed breakdown on the benefits and negatives of case study research in general. The methods used in Yin's approach, as well as *Grounded Theory* allow for a researcher to successfully defend a position and present information that is valid for understanding, and bettering, a situation.

The Case Study

For this dissertation, an industry problem was provided by a Department of Defense independent contractor. Department of Defense independent contractors are actively seeking how to implement industry 4.0 advancements into one of their organizations. The single advancement that I was tasked with was understanding how to implement product line engineering analytics. The goal and objectives that were set for the major product line engineering analytics were as follows:

Goal:

- Determine what data/measures/analytics need to be collected from engineering groups aligned with product lines.

Objectives:

1) Establish data collection and metrics reporting requirements
2) Establish processes to collect, analyze and report results
3) Pilot methods and processes
4) Revise and implement method and processes

While the goal statement provided by the independent contractor was only one sentence, accomplishing the goal would take much work. A tight timeline of just two business quarters defined as 180-days was provided to complete the implementation of product line engineering analytics. Determining what data, measures, and analytics need to be collected required a

tremendous breakdown, and a sustainable alteration of day-to-day operations for the group of interest. Many groups housed within organizations part of the Department of Defense are having the adapt to a new environment where information is constantly needed to make sound business decisions. As discussed earlier in chapter two the United States Air Force strongly believes that quantification of risk at critical decision points will drive the future of the digital thread, which is a major component of industry 4.0 (United States Air Force, 2013). Therefore, this case provided by the independent contractor came at the early stages of implementation of industry 4.0 into Department of Defense contractors.

Participants

Participation in this study was restricted to members on the identified team within the independent contractor in which this study was performed. All members of this study possess some level of national security clearance (classified, secret, or top secret). All participants of this study were employees of the independent contractor and collected their usual salary during the duration of this study. This study was labeled by the University of Central Florida Institutional Review Board (IRB) as an exempt study not requiring consent of human participates as the research revolved around collected data from processes within the organization.

Approach Used for the Case Study

There were a many of options for how to go about this case study. In this chapter, I discussed the three highly cited ways of Eisenhardt, *Grounded Theory*, and Yin for how to perform case study research. This case study falls under not only a holistic, single-case study, but an exploratory, holistic, single-case study. This determination was made by the fact that the research will address "what" and "how" questions (Yin, 2003). Similar to *Grounded Theory*, Yin believes there are six sources of evidence critical to case studies, those are (1) documentation, (2)

archival records, (3) interview, (4) direct observations, (5) participate observation, and (6) physical artifacts (Yin, 2017). To gather those six sources of evidence, Yin advises three principles to follow in collection of them, which are (1) use multiple sources of evidence, (2) create a case study database, and (3) maintain a chain of evidence (Yin, 2017). Lastly, Yin offers a framework protocol to increase reliability of the case study. The four sections of the protocol are (1) overview of the case study, (2) data collection procedures, (3) protocol questions, and (4) tentative outline for the case study report (Yin, 2017). Much of this research followed the direction given by Yin over his multiple years of case study research. Aspects of this research also followed *Grounded Theory* due to the coding and constant comparing, in addition to the memo writing to inform the key stakeholders of progress (Charmaz & Belgrave, 2007, Strauss & Corbin, 1994, and Navarro, & Montoya-Restrepo, 2016). In a matrix organization, the case study was unable to be completed without timely updates of progress, therefore understanding *Grounded Theory* was critical to the success of the case study.

Theoretical Framework (Ervin Change Sustainment Model)

As stated earlier in this chapter, an important step in case study research is the development of a rich, theoretical framework (Yin, 1994). Therefore, through extensive literature review, planning, and deep understanding of Department of Defense, independent contractors, the following rich, theoretical framework was created:

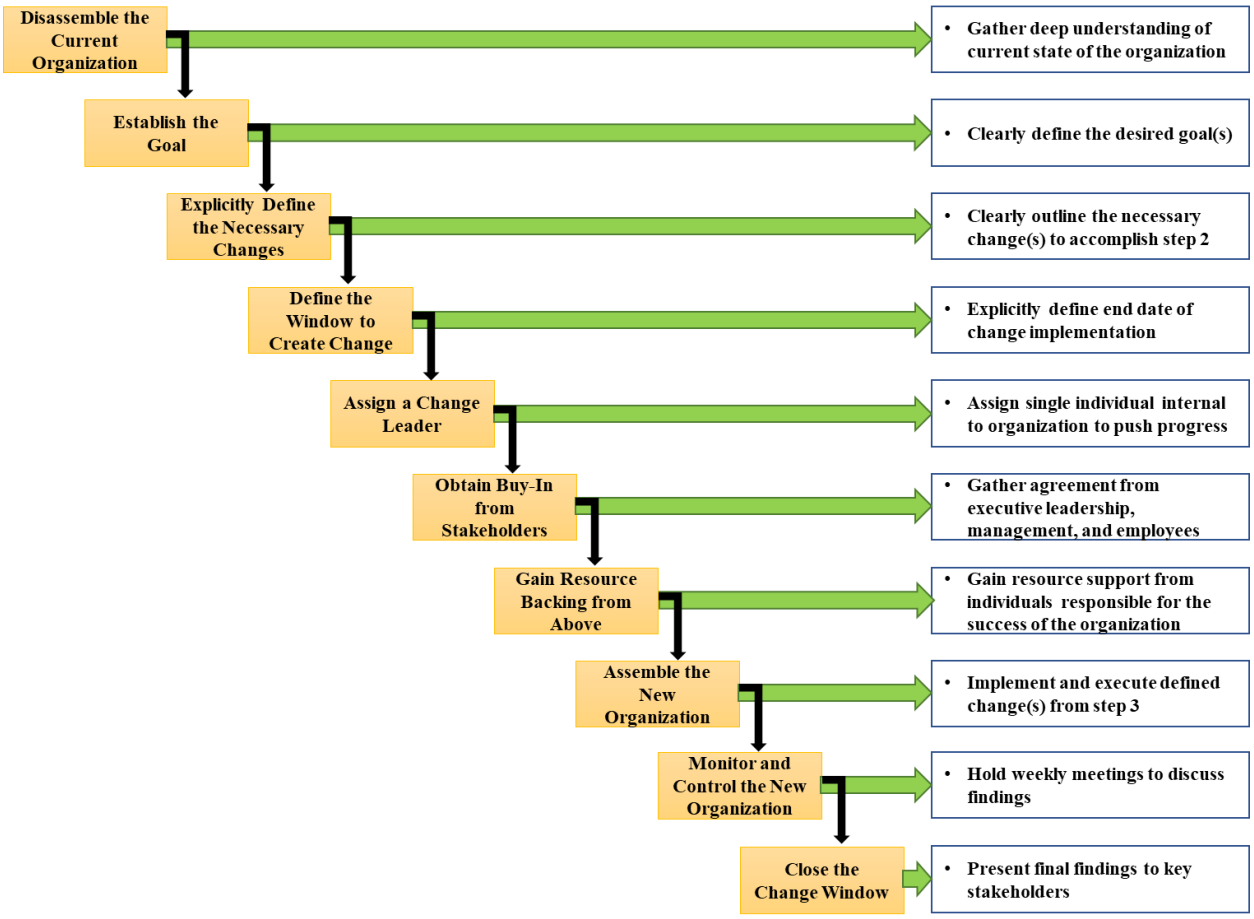

Figure 9: Ervin Change Sustainment Model

As discussed heavily throughout this dissertation, change models exist in the field of organizational development (Lewin, Judson, Jick, Kanter, Kotter, Luecke, and Hamel). They have all rightfully been shown in detail in chapter two of this dissertation. By thoroughly examining the existing change models, the literature that exists in the field, and considering the relevant personal experience I possess from having worked with Department of Defense contractors, it became clear that the need for a new model existed. Especially a model created within a classified environment that can create positive measurable change in two business quarters defined as 180-days. Having studied change, change management, organizational development, workplace psychology, and case study research, the creation of a theoretical

framework for a new change model that addresses the problems of the 21st century, as well as industry 4.0 became clear to conceive. Therefore, establishing this framework before the case study research began was followed per Yin's advice. A more defined text breakdown of the model can be seen below.

ERVIN CHANGE SUSTAINMENT MODEL

1) **Disassemble the Current Organization**
    a. Develop a deep understanding of the current state of the organization or group by disassembling the organization using engineering techniques such as value-stream mapping, process mapping, analytical narratives, descriptive statistics, and other techniques developed to understand construct.
2) **Establish the Goal**
    a. Clearly define the goal(s) wanted by the organization that if hit would make the change considered a success for all involved.
3) **Explicitly Define the Necessary Changes**
    a. Clearly outline how the processes and organization must be altered to reach the established goal(s) from step 2 of the model.
4) **Define the Window to Create Change**
    a. Explicitly define the target date where change implementation execution will end to therefore allow the organization to settle into its newly found state.
5) **Assign a Change Leader**
    a. Assign an individual internal to the organization who pushes the organization towards the defined goal(s) from step 2, and the change(s) necessary established in step 3 of the model.

6) **Obtain Buy-In from Stakeholders**
    a. Gather agreement from executive leadership, management, and employees, on the goal(s) established in step 2 of the model, and the change(s) necessary established in step 3 of the model to therefore gain a commitment to a successful change.
7) **Receive Resource Backing from Above**
    a. Gain resource support from individuals responsible for the success of the organization. This could include management and/or executive leadership depending on the state of the organization.
8) **Assemble the New Organization**
    a. Implement and execute the defined change(s) defined in step 3 of the model.
9) **Monitor and Control the New Organization**
    a. Hold weekly meetings to discuss findings and address (1) outliers effecting established goal(s) from step 2 and (2) outliers effecting necessary change(s) from step 3.
10) **Close the Change Window of the New Organization**
    a. End implementation of change(s) to allow for newly found state of the organization to settle into foundation.

These steps provide an organization the ability to walk through identification, implementation, and control in a way that allows for (1) both top-down and bottom-up stakeholder buy-in, (2) backing by industrial/organizational psychology principles of competence, autonomy, relatedness, intrinsic and extrinsic motivation, (3) a clearly defined goal that answers the question, “what are we aiming to accomplish by doing what we are doing?”, (4) sustainable

change that will not just be “flavor of the month”, and (5) executable within two business quarters defined as 180-days. The beauty of this model is that it allows for the addressing of 21st century problems created by the meteoric rise of technology and the onward direction of the fourth industrial revolution (industry 4.0).

Independent and Dependent Variables

For this dissertation, variables existed that could be tested to verify validity of the theoretical framework created to assist in addressing the case study problem presented by the independent contractor. In 2014, Al-Haddad ran a study that established change as an independent variable and change outcomes as a dependent variable (Al-Haddad, 2014). The results of that study showed that a positive correlation between change and change outcomes existed in some situations, as well as a negative correlation between change and change outcomes existed in other situations (Al-Haddad, 2014). Given that her study in the field of organizational development relates to my study in the field of organizational development, and that her study has been cited by other authors regarding validity, this study followed a similar setup of the independent and dependent variables. Given this, the variables below were observed to establish and verify if a there are any relationships between them:

- Change (independent variable) and Change Outcome (dependent variable)
    - Variables being addresses in the independent and dependent variable are below

Table 2: Independent and Dependent Variables of Dissertation

Independent Variable	Dependent Variable(s)
Analytics	Defects

Independent Variable	Dependent Variable(s)
Culture	Do we talk about "x" here?
	Is the environment "y" here?

The two independent variables analyzed in this study were (1) analytics and (2) culture. The changes that were implemented during the case study were implementation of analytics and altering of culture. To address implementation of analytics as a change to the independent contractor, culture needed to be addressed as discussed in previous chapters (Bean, 2009, Camci & Kotnour, 2019, Maras, 2017, Al-Haddad & Kotnour, 2015, and Kislik, 2018). Potential dependent variables of analytics as a change are (1) ROI (Return on Investment), (2) efficiency, (3) defects. To measure these variables, methods proposed by Corbin, Strauss, and Yin of reviewing archival records, reviewing participate observations, reviewing physical artifacts, and reviewing quantitative data were completed to understand the current ROI, efficiency, and number of defects the organization had exhibited previous to analytics being implemented (Yin, 2017, and Strauss & Corbin, 1994). These were only listed as potential dependent variables of analytics as the stakeholders within the independent contractor may identify other variables necessary to measure the success of the implemented analytics against. Potential dependent variables of culture as a change were measured using Likert Scale (strongly disagree to strongly agree). Those were (1) do we talk about "x" here and (2) is the environment "y" here? These binary questions addressed the factor of "what do we not talk about around here?" (White, 2019). To measure these binary questions, interviews and surveys were conducted before and after addressing the organizational culture.

Statistical Verification of Hypothesis

In the study, analytics was viewed as one of the independent variables. The Mann-Whitney U-Test was chosen due to its strength in handling small sample sizes. For culture as the independent variable, initially reliability analysis and factor analysis were chosen due to its strength in analyzing Likert Scales surveys. However, due to small population sizes for the survey, no estimating would be able to be performed, therefore reporting of means and standard deviations will be provided in the appendices of the dissertation. Logistic regression was considered due to its strength in analysis when the dependent variable(s) has binary (yes, no) responses (Brownlee, 2016), but the organization opted for Likert Scale over binary. Using Likert Scale for the survey showed what effect, if any, the changes made driven by the theoretical model to address the organizational culture had on the organization. Using the Mann-Whitney U-Test also showed what effect, if any, analytics can have on reducing number of defects, and other additional factors that were addressed. The hypothesis generated to be analyzed was the following:

(Null) H_0: There is no correlation between analytics and defects

- $R^2 = 0.0$ (no correlation present)

(Alt.) H_a: There is correlation between analytics and defects

- $R^2 > 0.0$ (correlation is present)

The purpose of this hypothesis was to verify and validate that the theoretical change model proposed could serve as a guide for how to effect organizational culture. In addition, for the purposes of the case study, this hypothesis also served to verify that analytics can influence ROI, efficiency, defects, and other variables that an organization may want to consider.

CHAPTER FOUR: RESULTS

Introduction and Limitations

This chapter presents the details of the data (qualitative and quantitative) that were gathered to test the research hypotheses and develop a strong analytical narrative as to the phenomenon that happens within an aerospace and defense private contractor organization. By using multiple ways of information gathering, a comprehensive assessment of the organization, in this case a major product line, was able to be performed. That led to the proposal and creation of specific changes intended to benefit the major product line. Within the major product line exists programs with characteristics that label a program as “large”, “medium”, or “small”. For this study, I was provided with one large program (Program A), one medium program (Program B), and one small program (Program C) from within the major product line to observe and implement changes that sought to be beneficial. While conducting the research using Yin and *Grounded Theory* in a mixed methodology fashion, situations and findings came about that were addressed appropriately to ensure the major product line continued moving towards the defined goal through use of the *Ervin Change Sustainment Model*. Throughout the research, the primary group of individuals responsible for data across the major product line observed were given surveys, interviewed, asked to participate in value stream mapping activities, and provide any documents that could aid in the creation of a baseline understanding of the initial state of the organization. As in all private companies, individuals move on to different roles inside and outside of the company, therefore surveys and interviews were conducted by position within the company to ensure that no matter who filled the position the responsibilities of the position were the same. Limitations of the study were vast given the national security aspects of performing such research. When reading the results of the study, it will be apparent that generic terminology,

numbers, and identifiers were used to be able to share the findings of the research. Any financial information given comes from the generic industry sources available to the public and will be averages taken from the U.S. engineering industry as whole. Given such limitations, and the imposed time constraints, the focus of this results section will be on what did occur and its implications to the major product line observed. Implications regarding the organization as a whole will be discussed further in chapter 5.

Understanding the Organization

Before step one in the *Ervin Change Sustain Model* could be performed, gathering a deep understanding of the initial state of the organization was critical. For this study, the organization observed was a major product line within the independent contractor. The major product line observed had several sub-product lines within it. That commonality exists across all product lines within the independent contractor. Given that the independent contractor follows a standard matrix organization format where functional departments and program departments equally share power of authority; meaning that most employees will get direction from at least two individuals. An example of the independent contractors' hierarchy within a product line can be seen below.

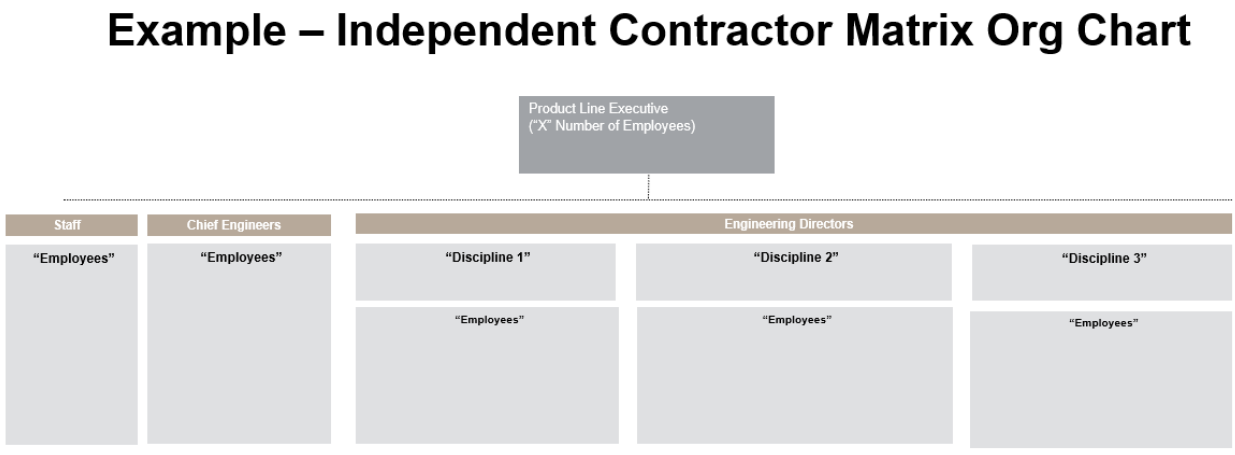

Figure 10: Example Matrix Org Chart – Independent Contractor

In order, at the top sits the Product Line Executive – This individual exists as the final decision maker for a product line. Followed by the Chief Engineers – These individuals exist as leaders of the sub-product lines under the overarching product line. Next will be the Engineering Directors – These individuals exist as leaders of the disciplines (i.e., systems, hardware, etc.). Rounded out by employees and managers existing to fill the needs of programs within each discipline. Understanding this breakdown was critical to gather the structure of the major product line being observed. This structure was common across the independent contractor. Inside of the major product line, there are a myriad of unique programs that span across the independent contractor's customers. The build of products within the major product line happens at many sites across the U.S. within the independent contract. For protection of the independent contract, and national security, detailed aspects of the major product line cannot be shared for public knowledge. The major product line itself reports its metrics through what will be referred to as the "engineering metrics" organization by assigning individuals within each discipline (i.e., software, systems, hardware, etc.) a set of programs in which to monitor. Once those metrics are reported on a monthly basis, engineering metrics then turns the metrics into a digestible display for all necessary stakeholders. For security purposes, an example of the display cannot be shown. The displays are generating through a complex gathering of raw data. Some of the steps used to gather the data from the multiple disciplines will be explained further in the next section.

Analytical Narrative Using the Developed Theoretical Framework: The Ervin Change Sustainment Model

Step 1: Disassembling of the Organization

Step one in the *Ervin Change Sustainment Model* is, "Disassemble the Current Organization". To complete this step, I first learned the initial state of the product line through

qualitative data techniques outlined in both Yin and *Grounded Theory* methodologies. One major component was the interviewing of individuals with a stake in the success of the organization. For this study, those individuals were located inside of (1) engineering metrics, (2) the major product line, (3) the disciplines, and (4) program management. Each of those departments had at least two individuals involved in the study, and therefore were the population used for the surveys given as well. The major takeaways from the interviews can be seen below.

Table 3: Software Engineering Quarter 3 Descriptive Statistics

Interviewee	Takeaways
Engineering Metrics (as a whole)	Some programs will never need attention, some need heavy attention
	Gathering the right data, gathering the data that you need
	Seamless digital thread of all the product lines and sub products
	Hierarchy of products, sub-products, disciplines, departments
	Implementing and Showing Improvement simultaneously is difficult
	Getting people to actually change and getting people to actually change
	Determining what is a defect
Major Product Line (as a whole)	Do not find that the metrics are being consistently collected
	A lot of the data collect are being done manual intensive
	Does not seem to be infrastructure where people can just pick up and go
	I want to have actionable data
	What metrics are going to be tracked?
	I think we're okay, but we can be better. Metrics can be a great leading indicator.
Disciplines (as a whole)	Who do I go to as the engineering belly button?
	Data getting ported into wrong project ID
	Individual functions seem to have 80% of their metrics unique from each other

Interviewee	Takeaways
	Spend more time fumbling around to get metrics for display than actually presenting
	Culture that uses defect containment versus one that doesn't
	Earlier you can find the defect, the cheaper the defect is
	Systemically standardized (collecting, inputting, displaying)
	Get down to the lowest level (getting people involved in the process, feel as if they have a seat at the table)
	Metrics must bigger than hardware (should be a program metric – a many of functions involved)
	Different managers like to see different things
	Do not have a many of engineering metrics
	Cost, rework, and dashboard to assist in visualization of information
Program Management (as a whole)	Getting leadership on board
	Program leadership should be labeling items as defects, not interns
	Report defects that are significant versus those that are not
	Culture of metrics have been so bad for so long, it's hard to get buy-in
	The more junior the person identifying the defects, the more likely it is to be mis-identified
	Encouraging communication regarding things going wrong

Once the interviews were complete, I was then able to create an affinity diagram to highlight major themes that came from the interviews. The four major themes were, (1) culture, (2) tools, (3) metrics areas, and (4) optimization. The complete affinity diagram scrubbed for national security purposes can be seen below.

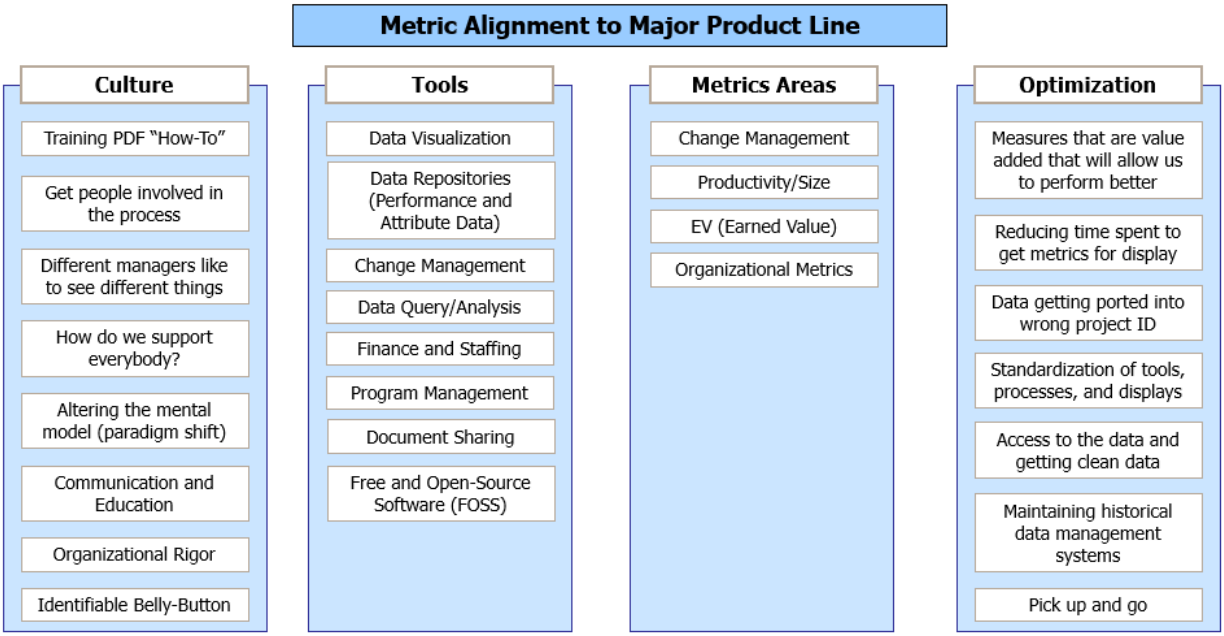

Figure 11: Major Product Line Affinity Diagram of Initial Interviews

Once the affinity diagram was complete, performing a prioritization of actions was completing using a quad-chart and the agile methodology known as MoSCoW. That acronym stands for Must, Should, Could, and Won't. In the quad-chart, the x-axis is defined by low effort and high effort, while the y-axis is defined by low impact and high impact. "Must" equates to "quick wins", "Should" equates to "big projects", "Could" equates to "low hanging fruit", and "Won't" equates to "skip if possible". By using MoSCoW to present the expected level of effort through a quad-chart, communicating a plan-of-action became easy. The prioritization can be seen on the next page.

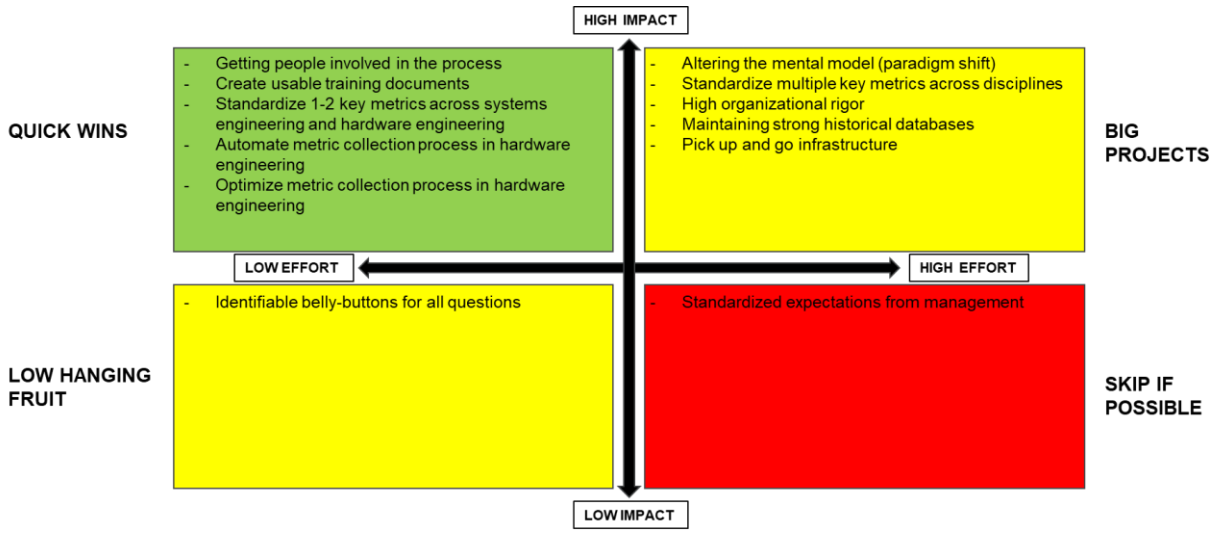

Figure 12: Major Product Line MoSCoW Prioritization Breakdown

The next major component of disassembling the organization was to perform a value stream mapping (VSM) activity. For this study, the disciplines as a whole were studied within the major product line. However, only VSM's were needed for the hardware and systems engineering disciplines. The major takeaways from the two VSM's were the following:

1) Common infrastructure, identifiable bellybuttons, and usable training documents would be highly useful
2) Good, clean data to drive business decisions is needed

From the systems engineering VSM, a 26-page document was provided to detail all inputs and outputs of each step needed to accomplish gathering and presenting critical systems engineering measures. This document was then vetted by the engineering metrics department, the systems engineering department, and the software engineering department within the major product line for accuracy and to point to the difficulty of presenting information. Due to the sensitivity of such document, it will not be presented within this dissertation.

From the hardware engineering VSM, a detailed instruction manual spanning six excel spreadsheets each with their own specific instructions was provided detailing all inputs and outputs of each step needed to accomplish gathering and presenting critical hardware engineering measures. This document was then vetted by the engineering metrics and hardware engineering departments within the organization for accuracy and to point to the difficulty of presenting information. Due to the sensitivity of those spreadsheets, they will not be presented within this dissertation. With the six spreadsheets, they must happen in an exact order, or they produce incorrect information upon analysis being performed. For software engineering, the data collection processes, and data reporting processes were mature enough to not require a VSM to deep dive into their operations.

The last major component of disassembling the organization was to perform an initial survey based upon everything previously discussed. 11 participates with stake in the major product line succeeding took the survey. Within the survey, questions were asked to (1) judge the organizations capability to change, and (2) understand the perceived autonomy of the work. The primary source of the questions was the Perceived Autonomy Support: The Climate Questionnaire obtained from the Center for Self-Determination Theory (CSDT, 2021). The questions asked within the survey can be seen in the appendices. All questions asked on the survey required answers, and answer choices used a standard Likert Scale format. The results are included in the appendices of this dissertation. The results of the initial survey showed that on the perceived autonomy support work climate questionnaire, the individuals within the organization who participated showed average to above average perceived autonomy. The results of the survey showed that on the organizations capability to change, the individuals within the organization who participated showed below average to average perception of the organizations

capability to change. What do these results mean? Organizational culture has potential to improve quickly through enhanced communication and clear understanding amongst multiple parties (i.e., words, phrases, and lingo meaning the same to everyone in every discipline). Employees who participated in the survey show a good amount of perceived autonomy, therefore enabling them through strong organizational culture could provide outstanding business results to the organization. This will be discussed further in chapter 5 of this dissertation. By completely disassembling the major product line, step one of the *Ervin Change Sustainment Model* was therefore completed.

Step 2: Establishing the Organizational Goal(s)

Step two in the *Ervin Change Sustainment Model* is, "Establish the Goal". Once step one was complete in totality, a set of goals were established that could be achieved given the discovered initial state of the organization. Those goals were as follows:

Goal 1: Standardize 1 Metric across Hardware Engineering and Systems Engineer

Goal 2: Optimize Hardware Engineering Metric Retrieval Process

Goal 3: Investigate How to Automate Hardware Metrics (if time permitted)

By establishing clear goals, step two of the *Ervin Change Sustainment Model* was therefore completed, and clear targets were established for what the study sought to accomplish.

Step 3: Explicitly Define the Necessary Changes

Step three in the *Ervin Change Sustainment Model* is, "Explicitly Define the Necessary Changes". For each goal established for the organization, necessary changes were identified to accomplish the goal.

Change 1: Outside of earned value (EV) metrics, standardize 1 metric that can be rolled up to the major product line, executive level for reporting of systems engineering, software engineering, and hardware engineering status.

Metric chosen: Defects

Change 2: Compile way of executing hardware engineering metric retrieval within short timeframe with less steps.

Change 3: Gather engineering data from a database and auto-generate metrics (software, coding, etc.).

Change 4: Standardize new definition of "defect" for reporting purposes.

By explicitly defining the necessary changes to accomplish the goals established for the organization, step three of the *Ervin Change Sustainment Model* was therefore completed.

Step 4: Define the Window to Create Change

Step four in the *Ervin Change Sustainment Model* is, "Define the Window to Create Change". As discussed in chapter 2 of this dissertation, shortened planning horizons and agile methodologies to accomplish change are a cornerstone of industry 4.0. For the purposes of this study and the major product line observed, the study was broken up into three phases, lasting 60-days each. Funding and resources to complete the study were provided for a period of two business quarters defined as 180-days. Due to time constraints of the study, business quarter one was defined as March, April, May and business quarter two was defined as June, July, August. Implying a one-month shift from the standard business quarter two and standard business quarter three. By establishing a window of time to create change, step four of the *Ervin Change Sustainment Model* was therefore completed.

Step 5: Assign a Change Leader

Step five in the *Ervin Change Sustainment Model* is, "Assign a Change Leader". As discussed in chapter 3 of this dissertation, the change leader must be internal to the organization. In this study, that would be someone with a stake in the major product line being successful. At this stage of the study, the role of the individual (i.e., me) performing the study then becomes a consultant to the change leader. The reasoning behind this revolves around ensuring an individual internal to the organization can push for the change to happen as they are already entrenched in the organization being successful through their employment with the organization. By performing organizational transformation in this way, the *Ervin Change Sustainment Model* can be used to execute change in any organization, in any company, in any industry. The phenomena that happened in this specific study was that the change leader did not need to be explicitly defined. The Engineering Metrics Department Manager organically slid into the role and was accepted by colleagues to lead the change internally. This will be discussed further in chapter 5 of this dissertation. By assigning a change leader internal to the organization, step five of the *Ervin Change Sustainment Model* was therefore completed.

Step 6: Obtain Buy-In from Stakeholders

Step six in the *Ervin Change Sustainment Model* is, "Obtain Buy-In from Stakeholders". As discussed heavily throughout this dissertation, stakeholders are those who have a direct stake in the organization succeeding. In this study, that was individuals with a direct stake in the major product line. Where some organizational change models discuss buy-in in a "top-down" manner or "bottoms-up" manner, the *Ervin Change Sustainment Model* discusses buy-in at all levels of the organization to create an organic want and need for change that will be sustainable for quite some time. Therefore, discussions with individuals who directly pull the data, work with the

products, middle-management, senior management, and executive leadership were had to obtain buy-in of the established goals created in step two of the *Ervin Change Sustainment Model* and gain acceptance of the change leader assigned in step five of the *Ervin Change Sustainment Model*. By obtaining the necessary buy-in at all levels of the major product line, step six of the *Ervin Change Sustainment Model* was therefore completed.

Step 7: Gain Resource Backing from Above

Step seven in the *Ervin Change Sustainment Model* is, "Gain Resource Backing from Above". Now that the foundation for organic transformation that can be sustained has been laid, meeting with the major product line executive and the major product line senior operations manager was quite productive. In this meeting, the study team consisting of the myself, the Engineering Metrics Department Manager (the assigned change leader), and other key stakeholders, were able to secure all necessary resources to be able to complete the pilot within the window of time defined in step four of the *Ervin Change Sustainment Model*. By gaining the necessary resource backing from above, step seven of the *Ervin Change Sustainment Model* was therefore completed.

Step 8: Assemble the New Organization

Step eight in the *Ervin Change Sustainment Model* is, "Assemble the New Organization". To do so, implementing changes defined in step two and step three of the *Ervin Change Sustainment Model* assembled to foundation of the new organization. Taking it from an "as-is" state to a "to-be" state. All organizational transformations must have time to settle to see long-lasting effects of the transformation, hence a longitudinal study could be performed later and will be discussed in chapter 5 of this dissertation. Changes implemented during this step are:

1) Introduction of new data collection tool for gathering of metrics

2) Common definition of defect used across disciplines within the major product line implemented

By implementing the above changes, step eight of the *Ervin Change Sustainment Model* was therefore completed.

Step 9: Monitor and Control the New Organization

Step nine in the *Ervin Change Sustainment Model* is, "Monitor and Control the New Organization". With the introduction of the new data collection tool, optimization of metric retrieval was able to be accomplished effectively. Using the tool allowed for program managers to input data regarding their respective program(s) in one place. Therefore, easing the load of the initial process defined during the hardware engineering and system engineering VSM activities. In addition, the common definition of defect allowed for in-phase and out-of-phase defects to be easily defined. In-phase meaning a production phase, while out-of-phase meaning a development phase or sustainment phase. Therefore, lowering the total of defects observed within each of the pilot programs. By monitoring and controlling the organization as the newly implemented changes settled, step nine of the *Ervin Change Sustainment Model* was therefore completed.

Step 10: Close the Change Window

Step ten in the *Ervin Change Sustainment Model* is, "Close the Change Window". Once the end of the two business quarters defined as 180-days arrived, the change window was closed. Results of the changes were analyzed in (1) a qualitative manner, (2) a quantitative manner, and (3) a practical manner. An analytical narrative was written to describe in totality what happened inside of the study to describe the phenomena which observed. That analytical narrative has been read in totality up to this point in this chapter. A comparison of the initial survey to the exit survey was performed. The same questions asked in the initial survey were asked in the exit

survey, which can be seen in the appendices. A statistical analysis comparing the quarter 3 data using the legacy defect definition to the quarter 3 data using the new defect definition was performed to determine statistical significance of results. A practical analysis comparing the quarter 3 data using the legacy defect definition to the quarter 3 data using the new defect definition was performed to determine practical implications of the results. Given the practical significance of the results, executives within the major product line, and the independent contractor as a whole were presented with findings. Discussion of those findings and conclusions will be discussed in chapter 5. By closing the change window for no further implementation of controls or changes, step ten of the *Ervin Change Sustainment Model* was therefore completed.

Quantitative Results Gathered Using the Theoretical Framework: The Ervin Change Sustainment Model

Program A – Relevant Descriptive Statistics: Quarter 3 to Quarter 3

Program A, the large program, results showed the following descriptive statistics for software engineering defects when observing the number of defects obtained using the legacy definition and the new definition for quarter 3.

Table 4: Software Engineering Quarter 3 Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Defects	6	10.5000	6.12372	4.00	22.00
Process	6	.5000	.54772	.00	1.00

Program A – Relevant Mann-Whitney U Test: Quarter 3 to Quarter 3

Once all data collection was completed at the end of August 2021, it was clear that the sample size would be too small for a normal distribution to be created. That means that the

assumptions for a paired t-test were violated, therefore a paired t-test could not be used for the statistical analysis. In substitution of a paired t-test, a Mann-Whitney U Test was completed to statistically test the following hypotheses.

(Null) H_0: There is no correlation between analytics and defects

- $R^2 = 0.0$ (no correlation present)

(Alt.) H_a: There is correlation between analytics and defects

- $R^2 > 0.0$ (correlation is present)

Using a 95% confidence interval, the results of the Mann-Whitney U Test are shown below.

Table 5: Software Engineering Quarter 3 Mann-Whitney U Test Results

Mann-Whitney Test

Ranks

	Process	N	Mean Rank	Sum of Ranks
Defects	Legacy	3	4.67	14.00
	New	3	2.33	7.00
	Total	6		

Test Statistics[a]

	Defects
Mann-Whitney U	1.000
Wilcoxon W	7.000
Z	-1.623
Asymp. Sig. (2-tailed)	.105
Exact Sig. [2*(1-tailed Sig.)]	.200[b]

a. Grouping Variable: Process

b. Not corrected for ties.

With a **P-value of 0.105**, the results of the Mann-Whitney U Test indicate that the null hypotheses cannot be rejected. Therefore, implying that there was no statistically significant correlation between implemented analytics and defects.

Program A – Practical Results Quarter 3 to Quarter 3

The total number of software engineering defects observed using the legacy definition of defects during quarter 3 of the study was 42 defects. The total number of software engineering defects observed using the new definition of defects during quarter 3 of the study was 21 defects. That indicates a 50% reduction in defects strictly within quarter 3 for the software engineering discipline of Program A. As reported by Program A, it took 1,197 engineering labor hours to address the 21 defects recorded using the new reporting process. That metric equates to 57 labor hours per defect. The average engineering manager salary in the U.S. in 2021 according to Glassdoor was $152,727 (Glassdoor, 2021). As noted by major audit, tax, and advisory services consulting firm Grant Thornton, wrap rates of government contractors can range between 1.8 and 2.2 (Grant Thornton, 2017). Implying wrap rates between 180-220%. Splitting the difference at 200%, that brings the fully burdened salary of the average engineering manager in the U.S. for 2021 to be $305,454. A labor year in the U.S. equals 2,080 (80hrs/paycheck x 26 paychecks), that average engineering manager hourly rate rounds up to approximate $150/hr. Those numbers imply that the average defect located in software engineering for Program A, not including material, costs $8,550. A chart representing the financial numbers previously discussed can be seen below.

Table 6: Software Engineering Quarter 3 Practical Results

Average Engineering Manager Salary in U.S. (Glassdoor, 2021)
$152,727.00
Government Contractor Wrap Rate (Grant Thornton, 2017)
200%
Average Engineering Manager Fully Burdened Salary in U.S. (Glassdoor, 2021, Grant Thornton, 2017)
$305,454.00 = ($152,727.00 x 200%)
Standard Labor Hour Year in U.S.
2,080 = (80hrs/paycheck x 26 paychecks)
Average Engineering Manager Fully Burdened Hourly Rate
~$150.00 = ($305,454.00 / 2,080)

Average Estimated Engineering Labor Hours per Software Defects (Program A)		
57		
Average Estimated Cost (not included material) per Software Defects (Program A)		
$8,550.00 = (57 x ~150.00)		
Total Number of Software Defects with New Process in Q3 (Program A)		**Total Number of Software Defects with Legacy Process in Q3 (Program A)**
21		42
Estimated Total Cost Spent (not including material) New Process		**Estimated Total Cost Spent (not including material) Legacy Process**
$179,550.00		**$359,100.00**

Given such significant savings of $179,550 using the new defect definition, practical indicators show a significant change. In addition to the cost savings, savings in hours amounted to 1,197 was observed. That amounts to 57.5% of a full-time equivalent (FTE) employee for the year. The return on investment (ROI) through savings of both necessary employees and money when aggregated has the potential to present great savings for the organization. This will be discussed further in chapter 5.

Programs B and C – No Indications

When performing a study such as this one, access to three programs within the same organization allows for the nature of industry to occur without hinderance to a study. As seen in this study, limitations due to the nature of industry came into play and were unavoidable. Due to the programmatic phases of programs B and C, as well as the efficiencies gained naturally by the programs, the two programs showed no defect data in any of the three disciplines throughout the duration of the study. In lieu of being unable to run a statistical analysis, practical positives were gained through establishing communication with programs B and C. By doing so, programs B and C are in the position to handle a more robust rollout of the newly created definition of a defect. As lack of communication was discussed heavily in the literature review as a major

problem in Department of Defense contractors, being able to address that with two programs was considered a huge win within the major product line.

Likert Scale Survey Analysis

By following Yin and *Grounded Theory* methodologies, a survey before the study began, and a survey when the study ended was critical for accessing organizational culture. The initial survey had a population of 11, which accounted for all the necessary stakeholders of the study. By the time the exit survey was released, two people from the initial population had moved on to other positions, therefore reducing the population of the study to 9. Given the population for the initial survey was 11, and the population for the exit survey was 9, these numbers are too small to estimate effects of factors using a reliability analysis and factor analysis. However, what can be reported is mean value of each question, standard deviation of each question, maximum of each question, and minimum of each question. That reported information can be seen in the appendices of this dissertation. What was also noted regarding the surveys was the score of the Perceived Autonomy Support: Work Climate Questionnaire. Initial survey results showed average to above average on perceived autonomy. Exit survey results also showed average to above average on perceived autonomy. This could indicate for the study group no change in perceived autonomy given the changes implemented. This will be discussed further in chapter 5.

CHAPTER FIVE: DISCUSSION AND CONCLUSION

Nature and Implications of the Study

Organizational change in classified environments has a good amount of literature that points to the difficulty of its execution. Research such as the one performed for this dissertation had many hurdles to overcome to complete. Some of those hurdles were the following:

- Shortened planning horizon
- Small window of time to execute change
- Lack of a randomized experimentation
- U.S. National Security
- Small population to observe

Given the nature of the study, being able to close the change window and deem the study a success was a major accomplishment for all involved. Pain points that the organization and the major product line had been feeling for years were addressed in the study. Due to the implications of the results, steps are being taken by the major product line to bring more programs into reporting using the new definition of defects. In addition to that, steps are being taken by the organization as a whole to implement the new definition of defects for reporting across other product lines.

Expansion of the Results

The nature of Program A in this study was unique in that it was considered a "large" program. Each major product line within the organization has several programs considered to be "large". The indications of the study show that the *Ervin Change Sustainment Model* works on programs considered to be "large". This was seen through analysis of the practical results. As an example, if a single major product line with 10 "large" programs implemented the *Ervin Change*

Sustainment Model and saw a 50% improvement in number of defects in at least one discipline, then the estimated cost savings would be just under $2 million at $1,795,500 per business quarter. Given there are four business quarters in a fiscal year, that number then grows to just over $7 million at $7,182,000 in annual savings. If the organization has at least four major product lines, that number then grows to just under $29 million at $28,728,000 in annual savings for the organization has a whole. Over a five-year business cycle, the total savings would be just over $140 million at $143,640,000. That would be in addition to the number of labor hours reclaimed to address the defects that can now be used to generate more sales and execute more productive work. Elimination of waste has long been a core principle of lean methodology, therefore, the return on investment (ROI) over the years, even in just a five-year period, would be substantial. With the nature of such a study, piloting efforts similar to this organization-wide would require some heavy lifting and diligent planning.

Understanding the Results of the Ervin Change Sustainment Model

The *Ervin Change Sustainment Model* produced significant practical results for the organization within a short timeframe. Being able to save just under $200k in one business quarter created tremendous implications that the organization could not ignore. As discussed throughout this dissertation, other change models exist each which their own unique steps. By introducing a new 10-step model that leaves very little room for guessing an organization has the ability to use the 10-step model as a roadmap to sustainable change. The 10-steps are:

1) **Disassemble the Current Organization**
2) **Establish the Goal**
3) **Explicitly Define the Necessary Changes**
4) **Define the Window to Create Change**

5) **Assign a Change Leader**
6) **Obtain Buy-In from Stakeholders**
7) **Receive Resource Backing from Above**
8) **Assemble the New Organization**
9) **Monitor and Control the New Organization**
10) **Close the Change Window of the New Organization**

By following these 10-steps in order an organization can see step by step how the process appears to be going. Throughout the study performed for this dissertation, notes and artifacts were placed in a single database to ensure that each step had a conclusion before moving on to the next step. The *Ervin Change Sustainment Model* as shown in this dissertation was associated with the significant change in defects seen in program A. While it may have the ability to work outside of organizations performing classified work, that has yet to be tested. Therefore, opening the door for some future research to do just that.

Impact to the Field of Organizational Change

The nature of dissertation research is to contribute something "new and novel" to field. To do that, an extensive literature review of the field, in addition to deep understanding of the field aids in ensuring that the research contributes "new and novel" knowledge to the field observed. In the field of organizational change, which includes organizational development, the gap analysis discussed in chapter 2 of this dissertation outlined a many of aspects where research could occur. For the study, I opted to focus on the following pain points in the field:

- Project management approaches that have aspects of agile will be needed to address appropriately (Camci & Kotnour, 2019)

- Limited information distribution and extensive compartmentalization of information serve as impediments (Maras, 2017)
- There exists a need for personalizing both the impact and the resolution of the change coming (Kislik, 2018)
- The digital thread and digital twin will drive industry 4.0 for DoD contractors (United States Air Force, 2013)
- New state is unknown, therefore requiring fundamental shifts in mindset, principles, behavior and/or culture (Anderson & Anderson, 2010)
- Change must be able to last (not a flavor of the month tactic)
- Change must be expedited, but in a calculated way to ensure thoroughness and long-term success

In chapter 2 of this dissertation, I expand upon many more pain points that the field of organizational development faces, however I felt these were the most critical to hit given the unique ability to perform industry research within a Department of Defense, independent contractor. This unique position that I found myself in allowed for research to be conducted that could push the field forward with first-hand knowledge. Through execution of the *Ervin Change Sustainment Model* key takeaways were obtained from the study. Those were as follows:

- Focused on both top-down and bottom-up implementation
- Used industrial/organizational psychology and motivational practices
- Had clear and defined goals
- Focused on Return of Investment (ROI) that was sustainment
- Executable within two business quarters defined as 180 days

The field of organizational change was ripe for this type of study and ripe for a new change model that could address the ever-evolving technological landscape that the U.S. currently faces with industry 4.0 and industry X.0.

Future Research

A multitude of studies could be performed following-up on the research performed in this study. The first would be one focusing more on organizational culture. This study happened at the corporate level of the organization, and therefore impacting organizational culture throughout the entire organization was going to be tough. Especially given the short window of time of two business quarters defined as 180-days. A whole study could be executed on just the alteration of organizational culture within a classified environment.

Another aspect to consider would be a longitudinal study as more programs get added, and more product lines get involved. Awaiting that to happen could take significant time. The questionnaires used in the survey are known psychology surveys, however their effect was not as strong as expected given such a short window of time to complete the study. Which opens up another potential form of research to be completed. All of these suggestions are for what could happen within the independent contractor organization observed, or other independent contractor organizations.

Outside of independent contractors, further research can be performed by partnering with organizations who offer industry 4.0 and industry X.0 technology to determine an effective and efficient rollout of necessary technology. In the study for this dissertation, focus was given to addressing one metric for standardization. Addressing that turned out to be with the addition of one piece of new technology. More technology that can accomplish other aspects of industry 4.0 and industry X.0 could be implemented to increase the agility of completing industry 4.0

efficiently and effectively. With regards to the study for this dissertation, further studies building on it can be accomplished with other independent contractors, if not able to be accomplished with the independent contractor observed for this study.

Final Remarks

The cost of organizational change is not cheap. As discussed in chapter 2 of this dissertation in detail, the Aerospace & Defense industry spends the least amount of money in industry 4.0 related transformations (PwC, 2016). If that continues, the gap between companies in the Technology industry (which spend the most money on industry 4.0 related transformations) and the Aerospace & Defense industry could seemingly grow to a point where closing the gap becomes even more difficult.

The field of organizational change has so much to offer. Given the change of the workforce as baby-boomers retire and millennials rise to senior leadership positions, the landscape of organizations will change with it. Research continues to show that the values of millennials are quite different than the values of baby-boomers, and therefore that also opens up potential research in the field to ensure that organizations are not only ready for the technological changes that must occur, but also the work environment changes that must occur. Organizations that cannot attract top young-talent will be at a disadvantage compared to those who can, and therefore the war of attrition has the potential to define organizations who aim to thrive in this generation.

Organizations will come and go, and disruptors will continue to arise in every industry with the goal of presenting a new way to accomplish something familiar to all. Whatever that next piece of technology may be, or that next company may present, the field of organizational change will have roots in all of it.

For this study, what I sought to accomplish was done. That was, using my created methodology to create significant change within two business quarters defined as 180-days within a classified organization. This research was “new and novel” to the field given that it occurred within a Department of Defense, independent contractor. While the change was not statistically significant, the resulting savings to costs and labor hours had tremendous practical significance. Therefore, this study was deemed a success by the organization and follow-on rollouts to other product lines and programs within the organization will come.

APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

NOT HUMAN RESEARCH DETERMINATION

November 20, 2020

Dear Hamilton Ervin:

On 11/20/2020, the IRB reviewed the following protocol:

Type of Review:	Initial Study
Title of Study:	Change Sustainment Model (CSM) to Address Industry 4.0 in a Classified Environment
Investigator:	Hamilton Ervin
IRB ID:	STUDY00002441
Funding:	None
Grant ID:	None
Documents Reviewed:	• Ervin_HRP-251- FORM - Faculty Advisor Scientific-Scholarly Review_IRB, Category: Faculty Research Approval; • Ervin_HRP-250-FORM- Request for NHSR, Category: IRB Protocol;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are research involving human in which the organization is engaged, please submit a new request to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Gillian Bernal
Designated Reviewer

APPENDIX B: MAJOR PRODUCT LINE INITIAL AND EXIT SURVEY QUESTIONS

The organization has an effective process for prioritizing changes it seeks to implement.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

The organization demonstrates commitment to making changes happen.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

The organization will devote enough time to drive change.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

The organization has the skill to support change.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

The organization has the correct processes in place to support change.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

The current culture within the organization encourages changes.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

The current organizational structure enables sharing of information.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

Decisions are made quickly within the organization.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

Decisions are clearly communicated within the organization.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

I feel that my management provides me options.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

I feel understood by my management.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

I feel my management listens to how I would like to do things.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

I feel encouraged by my management to ask questions.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

I feel my management tries to understand how I see things before suggesting a new way to do things.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

I feel that my management conveys confidence in my ability to do my job well.

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
○	○	○	○	○

APPENDIX C: MAJOR PROGRAM INTERVIEW QUESTIONS

Opening Questions

What is your role and what are your typical responsibilities in this role?
Walk me through your typical day/week?

Process

Pretend that I am a new employee on the team. Can you please give me an overview/ high-level of the current workflow?
How do you estimate the completion of work?
How well is your task defined?
What are the hardest things in this process for a new person to learn?

- Challenges/ barriers

What could be improved in the process?

People

How many different people are involved in this process?

Tools

What tools/systems/information do you need to use to execute this process?

- Where is information stored?
- How is this information accessed?
- How is the information populated?
- How do you share work?

How often do the people in the process communicate with one another?

- Via what means?

Ending Questions

Are there any issues/tasks/processes that we did not discuss that you'd like to comment on?
What are the easiest/best/least frustrating aspects of the process/tools/tasks to do today?
If there was one thing that you could change in the current process, what would it be? Why?

APPENDIX D: SURVEY DESCRIPTIVE STATISTICS

Q1		Q2		Q3		Q4	
N=11	N=9	N=11	N=9	N=11	N=9	N=11	N=9
Mean		Mean		Mean		Mean	
2.454545	3.888889	3.545455	3.666667	2.818182	3.777778	3.545455	4.111111
Std Dev		Std Dev		Std Dev		Std Dev	
0.655555	0.737028	0.78203	0.942809	1.113404	1.227262	0.655555	0.993808
Max		Max		Max		Max	
3	5	5	5	4	5	5	5
Min		Min		Min		Min	
1	3	2	2	1	1	3	2

Q5		Q6		Q7		Q8	
N=11	N=9	N=11	N=9	N=11	N=9	N=11	N=9
Mean		Mean		Mean		Mean	
3.272727	3.555556	2.727273	3.777778	3	3.333333	2.272727	3
Std Dev		Std Dev		Std Dev		Std Dev	
0.862439	0.684935	0.962091	0.916246	0.953463	0.942809	0.862439	0.666667
Max		Max		Max		Max	
5	5	4	5	5	5	3	4
Min		Min		Min		Min	
2	3	1	2	2	2	1	2

Q9		Q10		Q11		Q12	
N=11	N=9	N=11	N=9	N=11	N=9	N=11	N=9
Mean		Mean		Mean		Mean	
3	3	3.363636	3.777778	3.636364	3.666667	4	3.777778
Std Dev		Std Dev		Std Dev		Std Dev	
0.852803	0.942809	0.881396	1.030402	0.979121	1.333333	0.738549	1.396645
Max		Max		Max		Max	
5	5	5	5	5	5	5	5
Min		Min		Min		Min	
2	3	1	2	2	2	1	2

Q13		Q14		Q15	

N=11	N=9	N=11	N=9	N=11	N=9
Mean		Mean		Mean	
3.909091	3.888889	3.727273	3.888889	4	3.666667
Std Dev		Std Dev		Std Dev	
0.899954	1.196703	1.135454	1.099944	0.738549	1.247219
Max		Max		Max	
5	5	5	5	5	5
Min		Min		Min	
2	1	1	2	3	1

APPENDIX E: INSTITUTIONAL REVIEW BOARD CLOSURE LETTER

UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

NOT HUMAN RESEARCH DETERMINATION

September 30, 2021

Dear Hamilton Ervin:

On 9/30/2021, the IRB reviewed the following protocol:

Type of Review:	Study Closure
Title of Study:	Change Sustainment Model (CSM) to Address Industry 4.0 in a Classified Environment
Investigator:	Hamilton Ervin
IRB ID:	CR00001311
Funding:	None
Grant ID:	None
Documents Reviewed:	None

The IRB acknowledges your request for closure of the protocol effective as of 9/30/2021.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

UCF IRB

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