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# How does a Program Manager Gain Insight in the Complex and Chaotic Decision-Making Process?

December 2018

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# ABSTRACT

Leaders are inundated with complex decisions in chaotic environments that have ripple effects across any organization. This project studies Department of Defense program managers to better understand how a program manager creates situational awareness and understanding in chaotic program environments. Using qualitative research and conducting face-to-face interviews, this project focuses on how program managers gain insight in the decision-making process. This study provides a greater level of insight into these issues and will be the basis of future research. This study focuses on the emergence of six categories—sensemaking, consensus-making, trust, tacit knowledge, explicit knowledge, and the environment. Understanding the fundamental principles that guide decision-making will help program managers make sense of complex and chaotic program environments.

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# ABOUT THE AUTHORS

**MAJ Bradley R. Benjamin** is a native of Lansing, Michigan and was commissioned into the Infantry in 2008 as a Distinguished Military Graduate from DePaul University in Chicago, Illinois.

Following his commission, he was assigned to 1st Battalion (Airborne), 503rd Infantry, 173rd Airborne Brigade, Caserma Ederle, Italy where he served as a Rifle Platoon Leader in support of Operation Enduring Freedom X, Company Executive Officer, and Commander in support of Operation Enduring Freedom XII – XIII. In October 2013, MAJ Benjamin was assigned to 1st Battalion (Airborne), 501st Infantry, 4th Brigade (Airborne), 25th Infantry Division where he served as an Assistant Operations Officer and Heavy Weapons Company Commander. In May 2015, MAJ Benjamin was selected to join 3rd Battalion, 75th Ranger Regiment, where he served as the Air Operations Officer and Chief of Operations during multiple deployments in support of Operation Freedom's Sentinel. In May 2017, MAJ Benjamin joined the Acquisition Corps and earned his Master's in Business Administration from the Naval Postgraduate School. MAJ Benjamin currently serves as an Assistant Product Manager in Program Executive Office (PEO) Soldier, Fort Belvoir, VA.

MAJ Benjamin is a graduate of the Infantry Basic Officer Leader's Course, Maneuver Captains Career Course, the Naval War College Command and Staff Course, U.S. Army Ranger School, Infantry Mortar Leaders Course, Airborne School, Air Assault School, Pathfinder School, Jumpmaster School, and the Ranger Assessment and Selection Program. He holds a Bachelor of Arts in Political Science and a Master's in Business Administration.

MAJ Benjamin's awards and decorations include the Bronze Star Medal, Meritorious Service Medal (1 OLC), Joint Commendation Medal, Joint Service Achievement Medal, Army Commendation Medal (2 OLC), Army Achievement Medal (2 OLC), Afghanistan Campaign Medal (4 OLC), NATO ISAF Afghanistan Medal, the Global War on Terrorism Service Medal, Combat Infantryman's Badge, Expert

Infantryman Badge, Ranger Tab, Senior Parachutist Barge, Air Assault Badge, and Pathfinder Badge.

MAJ Benjamin is married to the former Cassie Sindorf of Stevensville, Maryland and has three children, Kennedi, Brooks, and Lucy.

**Major Jacob Z. Baker**, a native of Fayetteville Georgia, received his commission as an Infantry Officer in 2006 from the University of Alabama. Following commission, Jacob attended the Infantry Officer Basic Course and Ranger School at Fort Benning, Georgia.

MAJ Baker's initial duty station was Fort Campbell, Tennessee where his first assignment was with the Bravo Company 1-502 IN 2nd BDE 101st Airborne Division. Jacob deployed in support of Operation Iraqi Freedom where he served as a Rifle Platoon Leader north of Bagdad in the Shula district from December 2007 through November 2008. Following re-deployment, MAJ Baker served as the Battalion Mortar Platoon Leader for 12 months before departing to Fort Benning Georgia to attend MCCC. After completing MCCC, MAJ Baker was assigned to 2nd BDE (Stryker) 25th Infantry Division. He served under 1-21 IN as the Assistant to the Battalion Operations Officer for 10 months in support of Operation New Dawn (Northern Baghdad). After re-deployment, MAJ Baker commanded Alpha Company 1-21 IN for 18 months where he conducted multiple training deployments to the Pohakuloa Training Center (PTA) and Korea in support of Operation Foal Eagle. After his first Command with Alpha Company, MAJ Baker assumed command for Headquarters and Headquarters Company 1-21 IN, where he commanded for over 12 months. As the HHC Commander, he conducted multiple mortar training and evaluation programs, Medical, and Sniper training operations at PTA.

MAJ Baker attended the Army Acquisition Center of Excellence in 2014, where he was certified to execute responsibilities dealing with program management (51A MOS). MAJ Baker's first Acquisition assignment was an Assistant Product Manager for the Lethal Aerial Miniature Missile system (LMAMS) assigned to Close Combat Weapon Systems, PEO Missiles, and Space. MAJ Baker was directly responsible for LMAMS' fielding and training within the Special Operations Community resulting in over 60 successful combat

engagements in Afghanistan. Following LMAMS, MAJ Baker served as the product director for the development of the lightweight Command Launch Unit (CLU) for the Javelin missile system in Close Combat Weapon Systems. As the Integrated product team director, MAJ Baker led all system developmental efforts which resulted in a new CLU prototype ready for developmental testing in FY 2016. After his assistant program manager position, MAJ Baker was the lead material integrator for the TRADOC Capability Manager for Stryker. As the material integrator, he supported both the 30mm and Javelin weapon integration for the Stryker platform in support of 2CR's operational test.

MAJ Baker's military education includes the Infantry Officer Basic Course, the Maneuver Captain's Career Course, Ranger School, Airborne School, Air Assault School, and Infantry Mortar Leader Course.

MAJ Baker's decorations include the Bronze Star Medal (2 OLC), the Meritorious Service Medal (3 OLC), the Army Commendation Medal, the Army Achievement Medal, the Meritorious Unit Award, the Combat Infantrymen's Badge, the Expert Infantrymen's Badge, the Ranger Badge, the Airborne Badge, and the Air Assault Badge.

MAJ Jacob Baker is married to Ana Baker, and they have three sons, Jonah, Elijah, and Roman.

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We would like to express our gratitude and sincere appreciation to our families, who steadily supported us throughout the entire thesis process. Secondly, we are thankful for the mentorship, guidance, and support from Professor Raymond Jones and Bob Mortlock. Additionally, we are grateful for Program Executive Office for allowing the time for us to interview two extremely busy program managers; we were thankful to hear their career stories and lessons learned. Lastly, we would like to acknowledge LTC Patrick Baker's hard efforts to ensure our interviews were successful; his sponsorship allowed us to gather the correct data for this thesis.

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACAT | Acquisition Category |
| AI | Artificial Intelligence |
| APM | Assistant Product Manager |
| AT&L | Acquisition Technology and Logistics |
| DAB | Defense Acquisition Board |
| DAMS | Defense Acquisition Management System |
| DAWIA | Defense Acquisition Workforce Improvement Act |
| DCMA | Defense Contract Management Agency |
| DoD | Department of Defense |
| EMD | Engineering Manufacturing Development |
| IMCOM | Installation Command |
| IOT&E | Initial Operational Test and Evaluation |
| JAGM | Joint Attack Guided Munition |
| JCIDS | Joint Capability Integration Development System |
| LUT | Limited User Test |
| MDA | Milestone Decision Authority |
| NDM | Naturalistic Decision-Making |
| PEO | Program Executive Officer |
| PM | Program Manager |
| PPBE | Planning Programming Budgeting Execution |
| RDS | Recognition Decision Strategy |
| RDT&E | Research Development Technology and Engineering |
| RPD | Recognition Primed Decision |
| THAAD | Thermal High Altitude Area Defense |
| TMRR | Technology Maturation and Risk Reduction |
| TRL | Technology Readiness Level |
| VUCA | Volatile Uncertain Complex Ambiguous |

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# I. INTRODUCTION

The U.S. Department of Defense (DoD) has been managing weapons acquisition in support of war efforts dating back to the Second Continental Congress and the Revolutionary War. Since then, the acquisition process has become significantly more complex, morphing into a systematic process with phases, events, and a plethora of rules, regulations, laws, and statutes. Today, the DoD is one of the largest and most complex businesses in the world. It employs over three million people; has a budget of nearly $640 billion; manages plants, property, and equipment at over 5,000 different locations worldwide; and uses over 30 million acres of land (Department of Defense [DoD], 2018). The DoD's mission is to defend the homeland, deter war, and if necessary, defeat adversaries anywhere, anytime by land, sea, or air (DoD, 2018). In pursuit of this mission, the DoD equips the force with the most cutting-edge, disruptive, and leap-ahead technologies and instruments of war. The DoD program manager is responsible to lead this process. The program manager's job is to manage defense acquisition programs from cradle to grave and acquire technologies at the lowest cost and in a timely manner, while achieving the highest levels of technical performance.

## A. BACKGROUND

Program management is both a science and an art. The science of program management is the application of technical processes that produce technical solutions to satisfy key performance parameters with traceability to user requirements. The art of program management is the navigation of law and regulation and the skillful application of scarce resources to fulfill needs-based requirements, in an event-driven schedule, with time-based resources. Leadership traits associated with successful program managers include strong communication skills, the ability to think strategically, the capacity to think creatively, and the aptitude to promote teamwork. Program managers must make calculated decisions to support positive cost, schedule, and performance outcomes because their decisions are of strategic importance, affect human lives, and have ripple effects spanning several decades.

The environment in which program managers make decisions is complex and bureaucratic, requiring acquisition professionals who are highly trained and competent. Factors such as competing acquisition decision support systems, the rules and regulations that bind the process, the stakeholders who influence defense acquisition, the speed and complexity at which technology advances, and the rapid emergence of threats may lead to life-cycle management inefficiencies. Such factors may also help perpetuate defense acquisition reform.

Today, the user's demand for fast, reliable, and dependable equipment has pushed both political and military leaders to implement new organizations as a form of acquisition reform. The speed at which requirements are generated may be perceived as too slow, and the acquisition life cycle may be perceived as too long. Such perceptions have given birth to the Army's Futures Command, an organization designed to generate fast, accurate requirements and system prototypes before Milestone A and expedite weapon procurement through technology maturation. With the introduction of a new major command in the Army, there are potential complexities that will be introduced to the acquisition corps and the program manager. The system could be instrumental in fixing the requirements process, or it could simply add another layer of bureaucracy, adding more chaos and unpredictability into the decision-making process.

In addition to creating Futures Command, the office of Acquisition, Technology, and Logistics (AT&L) is being restructured to drive innovation and ensure warfighter dominance on the battlefield. This recent organizational change has divided AT&L into two different branches: Acquisition and Sustainment, and Research and Engineering. The intent is similar to the Futures Command approach, to create an environment conducive to producing rapid results for the user. Similar to the dilemma with the Futures Command, the program manager will have to navigate system-level decisions through more bureaucratic processes compared to the original AT&L organizational model. The creation of two separate organizations focused on different system outcomes will affect the decision-making process for future program managers.

Despite such attempts to reform DoD acquisition in the past, it appears that programs such as Joint Strike Fighter, Warfighter Information Network-Tactical, and

Future Combat Systems continue to underperform by exceeding their allocated budget, slipping schedule, or failing to produce. A factor potentially contributing to this issue is the difficulty in synchronizing the three interrelated decision support systems: The Joint Capability Integration and Development System (JCIDS), the Planning Programming Budgeting and Execution System (PPBE), and the Defense Acquisition Management System (DAMS). These decision support systems describe what to acquire, how much money the program manager is allocated, and the process in which such procurement will take place. However, the JCIDS process is needs driven, the PPBE process is calendar driven, and the DAMS is event driven, all of which may lead to inefficient program management. In theory, the three decision support systems work in concert, which provides the program manager a framework for delivering cutting-edge technologies to the warfighter in a timely fashion. In practice, synchronizing efforts across the three pillars seems to be a daunting task and if not accomplished, may lead to underperforming programs. This may create an unforgiving environment for the program manager, the warfighter, and our industry partners. As a result, the program manager may be more prone to be risk averse, make decisions in an untimely manner, and let environmental factors influence decision-making, in place of best business practices or urgency of requirements.

Further adding complexity to DoD acquisition is the plethora of rules, regulations, laws, and statutes governing the process and the levels of oversight from several competing entities. Organizations such as Congress, the executive branch, industry, the Office of Management and Budget, the Office of the Secretary of Defense, military materiel commands, and service acquisition executives influence and oversee the DoD acquisition process. These organizations have produced hundreds of thousands of pages of regulations, laws, and statutes that program managers must navigate when managing a program. This oversight and these regulations have slowed all aspects of the acquisition process from implementing contracts, to generating requirements, and conducting test and evaluation.

Complexity is further introduced into the acquisition environment by our adversaries. We live in an environment when our adversaries are adopting new methods and means to challenge the United States. They are developing multi-domain threats, hybrid strategies, and nuclear weapons, and are capitalizing on advancements in robotics, cyber, space and hypersonic. Threats such as Russia and China pose near peer capabilities

and are considered pacing threats to the United States. North Korea and Iran continue nuclear proliferation, and radical ideologues and trans-regional organizations like ISIS and Al Qaeda remain threats. Technologies such as laser and radio frequency weapons, swarms, synthetic biology, rail guns, artificial intelligence (AI), and autonomous equipment will disrupt future warfare. These emerging threats have fueled acquisition reform, stimulated the development of rapid acquisition procedures, and further complicated the environment in which the program managers operate.

## B. PURPOSE STATEMENT

The purpose of this research is not to understand how program managers make decisions, but rather, to recognize how a program manager gains insight in the decision-making process. Despite decades of acquisition reform, programs continue to underperform and experience cost, schedule, and performance slippages. In an environment so dynamic and complex, it is imperative to understand how a program manager creates situational awareness and understanding in chaotic program environments and how it correlates with program performance.

## C. PROBLEM STATEMENT

The problem is that there appears to be a knowledge gap in current literature in understanding how program managers formulate their view of the world to make complex decisions.

## D. SCOPE

We interviewed two active duty Army program managers in the rank of colonel who currently manage ACAT I Major Defense Acquisition Programs. This allowed us to gather precise data about the decision-making process in the DoD acquisition environment through personal experience. The interviews were conducted face-to-face and lasted roughly one hour each. We conducted our research in a time-constrained environment spanning a period of five months.

## E. METHOD

This study was conducted using a modified grounded theory method for conducting qualitative research focused on obtaining data through a series of questions. Contrary to conducting quantitative research, which focuses on gathering available numeric data to prove or disprove a theory, qualitative research uses observation of human behavior in a specific environment to gather non-numeric data and generate a theory to support such data. To obtain the necessary data to conduct our analysis, we began by reviewing relevant information regarding the decision-making process. In doing so, we gained the requisite amount of knowledge required to understand how humans gain insight into the decision-making process. This information is presented in Chapter II, Literature Review.

In collecting our data, we utilized the one-on-one interview method. Compiling such data allowed us to conduct inductive cross-coding and categorization. The purpose of cross-coding and categorization is to index information themes to better understand the data presented from the interviews. Ultimately, the purpose is to become more aware of how a program manager gains insight into the decision-making process.

Following the coding and categorization process, we provide an in-depth analysis of the data and illuminate the results of the interview process. We then analyze the data to gain an understanding of how a program manager gains insight into the decision-making process. Finally, we conclude by introducing two hypotheses and theories that we deduced from the analysis of the data.

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# II. LITERATURE REVIEW

## A. CHAPTER OVERVIEW

The intent of this chapter is to highlight literature written on individual and organizational decision-making, and the factors associated with each. First, the history of decision-making is presented to establish a baseline understanding of how cognitive psychology has evolved over time. Second, sensemaking and how environmental factors can influence the Cynefin Framework are illuminated. Third, analytical, intuitive, and dual process decision-making theories are explained. Fourth, an extensive review of the characteristics of naturalistic decision-making (NDM) from both an individual and organizational perspective is conducted. Finally, Klein's recognition-primed decision model and Rasmussen's decision-making process are revealed.

## B. HISTORY OF DECISION-MAKING

The history of decision-making can be traced back several thousand years from the prehistoric era to the 21st century. Knowing the historical background and the evolution of decision-making will facilitate our research and help illuminate specific areas of the decision-making process that impact how DoD program managers make complex decisions. Figure 1 presents a timeline of major developments in decision-making theory. Throughout history, human beings have studied human behavior, psychology, the cognitive process, and problem-solving to make sense of how decisions are made and why. Countless philosophies, theories, and terms have been coined to help dissect and understand the practice. Buchanan and O'Connell (2006) note that the earliest records of decision-making literature highlight the fact that human beings' decisions were guided by consultation with the gods through interpretations of dreams, entrails, and smoke. The authors found that the early Greeks, for example, would travel to the Delphi oracle and consult the gods prior to making any major decision. They further state that during this period, people believed that they did not have any control over the decision-making process.

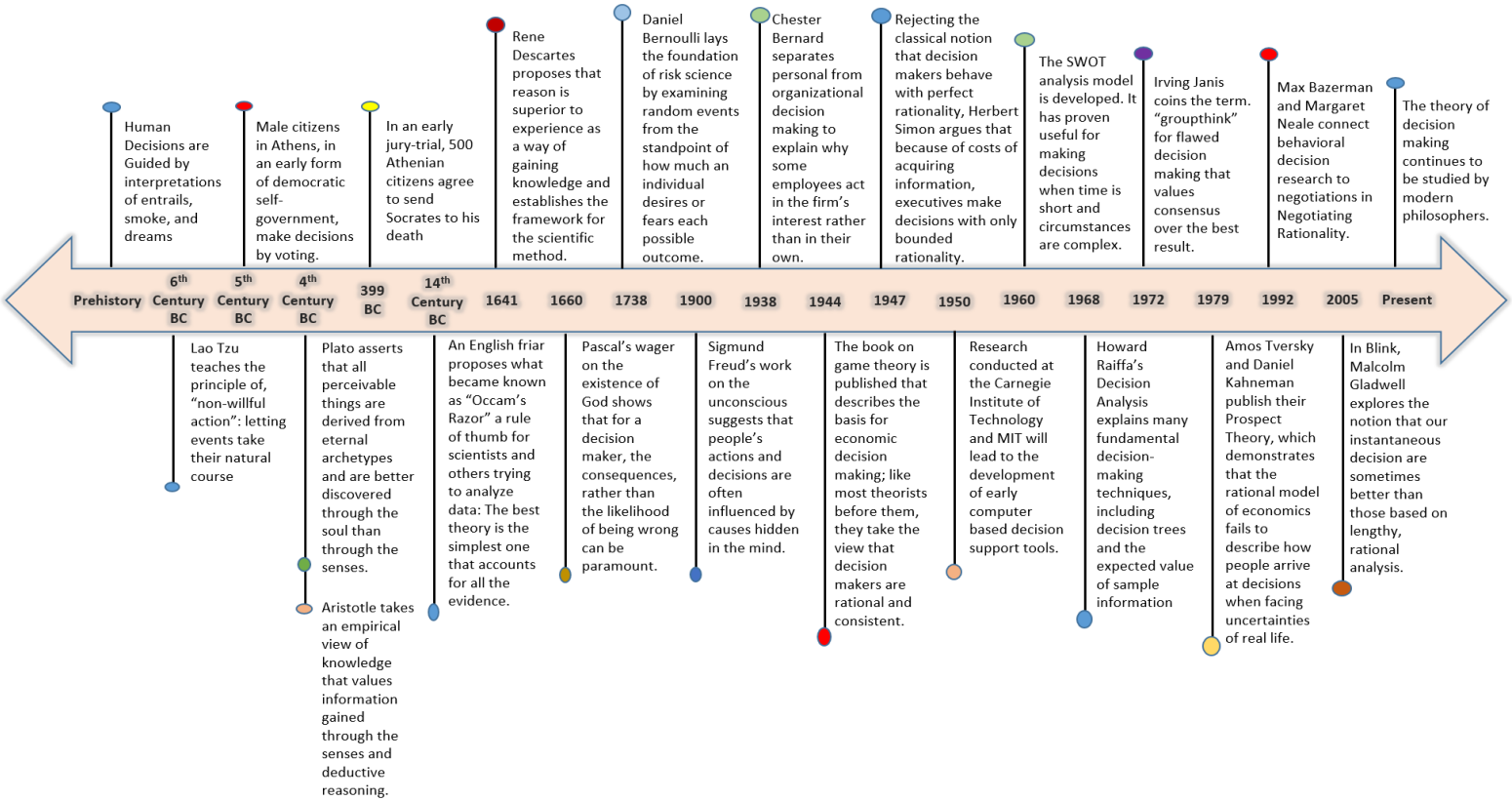


Figure 1. History of Decision-Making. Source: Buchanan and O'Connell (2006).

In the fourth century B.C., the Athenians introduced voting as a method of decision-making (Ober, 2007). In fact, Socrates was put to death after a public trial in which 500 Athenian citizens voted and found him guilty of corrupting the minds of the young (Ober, 2007). Continuing his philosophical debates were Plato and Aristotle who contributed greatly to the study of decision-making (Ober, 2007). They debated how things were perceived and how knowledge was gained (Ober, 2007). On one hand, Plato argued that one makes decisions based on the soul and not the senses (Ober, 2007). Contrary to this philosophy, Aristotle believed that people make decisions on the information gained through the senses (Ober, 2007). The gut versus brain dichotomy is still alive today and discussed at great length in several scholarly articles and bodies of knowledge relating to the study of decision-making.

In the 17th century, mathematician Daniel Bernoulli contributed greatly to the fields of probability and statistics (Faccarello, 2016). Bernoulli began studying the subject of random events and how a human could use statistics and probability to make decisions that would be in their best interests (Faccarello, 2016). This laid the foundations of risk management, a practice used in almost every business organization today (Faccarello, 2016). Bernoulli's work paved the way for several other theorists such as Carl Friedrich Gauss and Francis Galton, who gave birth to the bell curve of normal distribution and the concept of regression (Buchanan & O'Connell, 2006). Such statistical and data analysis tools remain the bedrock of complex decision-making to this day.

In the early 1900s, theorists such as Nobel laureate Herbert Simon greatly contributed to the body of knowledge on complex decision-making (Buchanan & O'Connell, 2006). Simon spent his whole life researching the decision-making process and is known for his theories of bounded rationality and satisficing (Buchanan & O'Connell, 2006). Simon believed that human beings are not rational thinkers and that they are only as good as their cognitive capabilities (Buchanan & O'Connell, 2006). This thought gave birth to artificial intelligence, a field in which Herbert Simon is known as a pioneer (Buchanan & O'Connell, 2006). Simon's contribution to the study of decision-making was enormous and continues to influence modern-day theorists.

Today, theorists such as Amos Tversky, Daniel Kahneman, James March, and Henry Mintzberg carry the torch handed off from Herbert Simon and other prominent preceding theorists (Buchanan & O'Connell, 2006). Their contributions have led to the development of Prospect Theory, groupthink, organizational decision-making, strategic decision-making, and several heuristics attempting to simplify the decision-making process (Buchanan & O'Connell, 2006). Their research continues to highlight that risk is inescapable in any line of work (Buchanan & O'Connell, 2006). Whether it be in combat, on Wall Street, in the acquisition community, or in personal life, the decisions one makes carry a certain level of risk that must be mitigated during the decision-making process. Decision-making and risk mitigation is a game of numbers that continues to evolve over time but which was conceived thousands of years ago and molded into what it is today (Buchanan & O'Connell, 2006).

Over time, the study of decision-making has become one of multiple disciplines: mathematics, sociology, psychology, economics, political science, and philosophy (Buchanan & O'Connell, 2006). DoD program managers make complex decisions on a daily basis that span each of these disciplines. The methods by which decisions are made have evolved from consulting the Greek gods and the stars, to relying on the latest technologies, such as artificial intelligence, to facilitate the process (Buchanan & O'Connell, 2006). As we further understand the human factors associated with problem-solving, risk mitigation, and the cognitive process, we will better understand the complex decision-making process (Buchanan & O'Connell, 2006). With the continued rapid evolution of technology, a program manager's ability to make decisions in the future will become only more complex and convoluted as we become overly saturated with layers of information (Buchanan & O'Connell, 2006). Human beings will continue to rely on such information technologies to make decisions because of the understanding of such theories as bounded rationality and to offset cognitive limits (Buchanan & O'Connell, 2006).

Possessing an understanding of the historical evolution of the decision-making process helped shape the direction in which we executed our research. The next several pages of our research introduce the reader to relevant topics such as sensemaking, analytic and intuitive decision-making, organizational and individual decision-making, and several theories associated with each. We felt that understanding these areas of research would

provide the requisite level of knowledge to gain an understanding of how program managers acquire insights into the decision-making process.

## C. SENSEMAKING

We determined that understanding the subject of sensemaking was critical to the overall success and purpose of our research. It will help us to understand how sensemaking impacts the decision-making process within the DoD acquisition framework. Furthermore, it will allow us to better understand how program managers use sensemaking in complex environments to gain insight into the decision-making process. Sensemaking is an important aspect of decision-making because some decisions are made based on interpretation derived from sensemaking (Weick, 1995). The following paragraphs highlight relevant material written on the subject of sensemaking.

Sensemaking has been an area of increased study and relevance since the turn of the 20th century. Theorists Harold Garfinkel and Karl Weick were among the first to introduce the term in the early 1960s (Maitlis & Christianson, 2003). Since then, the study of sensemaking has rapidly evolved. In the 1980s, studies were conducted to research the cognitive underpinnings of sensemaking and how the environment impacted decision-making (Maitlis & Christianson, 2003). In the 1990s, studies were conducted to illuminate factors of sensemaking during times of crisis (Maitlis & Christianson, 2003). In the 2000s, the study of sensemaking has evolved to include the impact of sensemaking on organizations, and how the factors of power and emotions influence the process (Maitlis & Christianson, 2003). As result of such in-depth study, several heuristic models exist today to help individuals and organizations navigate complexity and make better non-programmed decisions.

Defining the term *sensemaking* is an area of considerable debate. Some theorists describe sensemaking as a cognitive process, perspective, or model, while others describe it as a theory (Maitlis & Christianson, 2003). However, most theorists agree that "sensemaking has many distinct aspects—comprehending, understanding, explaining, attributing, extrapolating, and predicting.… What is common to these processes is that they involve putting stimuli into frameworks that make sense of the stimuli" (Maitlis & Christianson, p. 62). Maitlis and Christianson (2003) extrapolated the definitions of over

15 different theorists to define sensemaking as "a process, prompted by violated expectations, that involves attending to and bracketing cues in the environment, creating intersubjective meaning through cycles of interpretation and action, and thereby enacting a more ordered environment from which further cues can be drawn" (p. 67). Regardless of the definition, sensemaking is an important aspect worth studying to understand how DoD program managers make decisions.

There are several characteristics associated with sensemaking. In his 1995 book, *Sensemaking in Organizations*, Karl E. Weick identifies seven characteristics of sensemaking: grounded in identity construction, retrospective, enactive of sensible environments, social, ongoing, focused on and by extracted cues, and driven by plausibility rather than accuracy. According to Weick (1995), "These seven characteristics serve as a rough guideline for inquiry into sensemaking in the sense that they suggest what sensemaking is, how it works, and where it can fail" (p. 18).

Sensemaking generally leads to two different types of decisions: programmed and non-programmed. Programmed decisions are highly repetitive and require simple routine approaches to solving issues (Woehrle, 2011). For example, grabbing a bite to eat when hungry or changing a password on a computer are programmed decisions. On the other hand, non-programmed decisions are severely complex with ill-defined methods for determining a solution (Woehrle, 2011). Making programmatic decisions within an acquisition strategy for new disruptive technologies to counter hybrid, conventional, and non-state actor threats is an example of a non-programmed decision. The level of complexity, defined by the number of interacting agents, is much higher in non-programmed decision-making than in programmed decision-making.

DoD program managers make hundreds of decisions each day and live in a world that constantly fluctuates. Some decisions are more complicated than others and have greater consequences if incorrect. Several factors impact the decision-making process, including the ability to make structure amid ambiguity and to comprehend the operational environment—sensemaking. A program manager's ability to be effective during the decision-making process is dependent on understanding the social, political, legal, cognitive, and environmental factors of defense acquisition. At the core of the sensemaking

process is the program manager's desire to organize ambiguity and uncertainty into something comprehensible (Maitlis & Christianson, 2003). In theory, when program managers make sense of their environment, the act of making a decision becomes much easier. The next few pages of this research highlight two heuristic sensemaking models and how they might apply to a program manager's decision-making process.

## D. CYNEFIN FRAMEWORK

The Cynefin Framework facilitates the sensemaking process and helps leaders gain insight to the environment in which they are expected to make informed decisions. Figure 2 presents an overview of the Cynefin Framework. It was created by David Snowden in 1999 and offers a structure for leaders to identify a problem and catalog it in a domain and a method by which the problem can be approached (Snowden & Boone, 2007). Cynefin is considered a sensemaking model and not a categorization model (Kurtz & Snowden, 2003). Therefore, as opposed to a categorization model, the data precedes the framework (Kurtz & Snowden, 2003). As a result, "the framework is used primarily to consider the dynamics of situations, decisions, perspectives, conflicts, and changes in order to come to a consensus for decision-making under uncertainty" (Kurtz & Snowden, 2003). The Cynefin Framework can be a useful decision-making tool for many organization dealings with complex systems and when making non-programmed decisions. The Cynefin Framework is broken down into five domains and two environments: simple, complicated, complex, chaotic, and disordered domains, and the ordered and un-ordered environments (Snowden & Boone, 2007). Simple and complicated contexts fall under what Snowden considers an ordered environment, whereas complex and chaotic contexts fall under an un-ordered environment (Snowden & Boone, 2007). In an ordered environment, there is a correlation between cause and effect, and a distinction between what is known and what we must still learn to understand our environment, enabling problem-solvers to quickly apply technical skill and best practices to alleviate issues (Kurtz & Snowden, 2003). In an un-ordered environment, the link between cause and effect is complicated by the number of interacting entities or non-existent entities, which becomes more problematic for the decision-maker, forcing him to regain control and analyze patterns in the environment to shape decisions (Kurtz & Snowden, 2003).

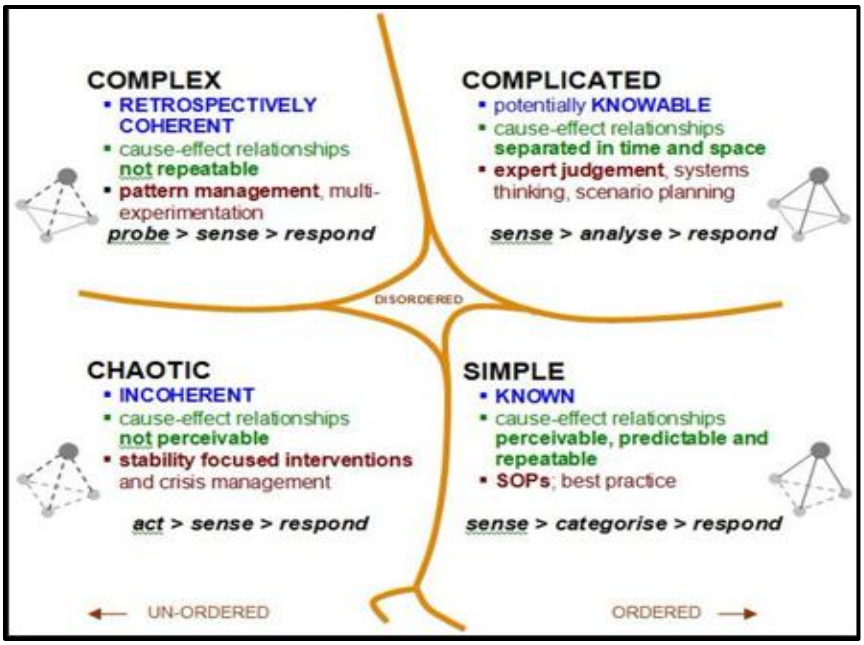


Figure 2. Cynefin Framework. Source: Snowden and Boone (2007).

Leaders in the DoD have created several heuristics and best practices, such as Better Buying Power, to abridge the complex acquisition system into the simple domain. The simple domain is characterized as the domain of best practices and standing operating procedures, because cause-and-effect relationships are well understood, and decisions in this domain are straightforward, obvious, and conditioned (Snowden & Boone, 2007). Operating in the simple domain is ordered and the approach that one takes is to sense, categorize, and respond (Snowden & Boone, 2007). For example, a program manager would identify the problem (sense), categorize it, and then respond using an established best practice or SOP. As a result, problem-solving and decision-making in the simple domain require minor coordination with team members (Snowden & Boone, 2007). In the world of defense acquisition, office administrative functions, day-to-day operations, email correspondence, and the processing of paperwork are examples of operations in the simple domain. Problem-solvers in this domain know what the effects of their actions will be before they are executed (Snowden & Boone, 2007).

Because the world of defense acquisition is complex and strategic in nature, it requires a certain level of expertise and professionalism, specifically, Defense Acquisition Workforce Improvement Act (DAWIA) Level III certification for product managers and

above. Such expertise is required by problem-solvers who operate in the complicated domain of the Cynefin Framework (Snowden & Boone, 2007). The complicated domain is categorized as an ordered environment, and there is still a link between cause and effect, but it is not as strong as in the simple domain (Snowden & Boone, 2007). Operational outcomes in this domain are still predictable but require expertise to determine future actions (Snowden & Boone, 2007). The approach one takes in the complicated domain is to sense, analyze, and respond (Snowden & Boone, 2007). Problem-solvers in the complicated domain require technical expertise to identify the root cause of the issue, and apply good practice options, instead of best practice, to solve the issue while mitigating known risks in the process (Snowden & Boone, 2007). Consider a program manager tailoring the acquisition strategy to reduce the Technology Maturation and Risk Reduction (TMRR) phase because the product has already achieved a technology readiness level (TRL) of 6, an example of operating in the complicated environment.

Most major defense acquisition programs operate in the complex domain because the development of leap-ahead and disruptive technologies is complicated, the number of stakeholders involved is extraordinary, and the sheer number of constraints is cumbersome. Entering the complex domain is a shift into the unordered environment, and the correlation between cause and effect diminishes but can still be perceived through pattern analysis (Snowden & Boone, 2007). Problem-solvers in this domain cannot predict that an action will provide a favorable result but must work to understand unpredictable evolving patterns to gain insight into the situation (Snowden & Boone, 2007). Since problems in the complex domain are not linear in nature, experimentation is critical to identify positive outcomes and build on them (Snowden & Boone, 2007). The approach one takes in the complex domain is to probe, sense, and respond (Snowden & Boone, 2007). The objective is to "develop open-minded observation rather than hasty action based on preconceived ideas" (Van Beurden, Kia, Zask, Dietrich, & Rose, 2011, p. 77). Technical expertise and established procedures alone will not solve problems that fall under the complex domain (Van Beurden et al., 2011). A high level of collaboration among stakeholders is required to overcome such issues (Van Beurden et al., 2011).

Chaos ensues when the relationship between cause and effect is nonexistent and when order must be restored immediately (Kurtz & Snowden, 2003). In the chaotic domain,

the scope of the problem and root cause is unknown, and there is no time for inaction or indecision (Kurtz & Snowden, 2003). The approach the problem-solver must take is to act, sense, and respond (Kurtz & Snowden, 2003). Like stopping the bleeding by applying a tourniquet on a trauma patient, the first thing the problem-solver must do in the chaotic domain is to regain control, stability, and order (Kurtz & Snowden, 2003). The chaotic domain is crisis management where order must be restored before analyzing patterns, applying technical expertise, and leveraging protocols to deal with an issue (Van Beurden et al., 2011). Restoring order amid chaos often requires an innovative problem-solving approach (Van Beurden et al., 2011). An example of this in defense acquisition would be a production line going down. In this event, the program manager must quickly act to turn the line back on and continue to operate in the complex and complicated domains resolving problems.

At the center of the framework lies the domain of disorder. This domain is characterized by sheer confusion and competing perceptions of what domain the problem-solver is operating in (Kurtz & Snowden, 2003). A lack of cooperation exacerbates the problem when operating in the disordered domain, and biases cloud individual and collective judgment of the situation (Kurtz & Snowden, 2003). Differences in duty position, age, experience, and education level can perpetuate issues and prevent resolution, fueling a state of prolonged disorder. Because of such biases, people tend to fit problems into a domain space that they feel most comfortable operating within, but not necessarily the domain space to which the problem actually belongs (Kurtz & Snowden, 2003). It is essential for decision-makers to come to an agreement to act to address the problem (Kurtz & Snowden, 2003).

The Cynefin Framework can be a highly effective sensemaking tool that helps program managers make sense of the environment to make informed decisions, while mitigating known risk. Using the framework as a sensemaking tool enables the problem-solver to operate in a constant state of flux and measure the varying degree of complexity in the process (Van Beurden et al., 2011). It is best to operate in the complicated and complex domains because it fosters a culture of adaptation, creativity, flexibility, and emergent practices (Van Beurden et al., 2011). If operating too much in the simple domain, leaders become complacent, and if operating too much in the chaotic domain, leaders are

most likely indecisive (Van Beurden et al., 2011). The worst-case scenario is when a problem crosses the boundary line from the simple domain directly to the chaotic domain, triggering crisis management that is difficult to apply due to the stagnation of operations in the simple domain (Kurtz & Snowden, 2003). Recovering from this situation requires not only creating order, but redesigning protocol, educating decision-makers to achieve a higher level of expertise, and changing the culture of an organization to become much more analytical (Kurtz & Snowden, 2003). Utilizing the Cynefin Framework can help the problem-solver manage complexity and make decisions based off intuition and analytics. The next several paragraphs of research describe the difference between intuitive and analytical decision-making and highlight the importance of each on the process.

## E. INTUITIVE AND ANALYTICAL DECISION-MAKING

Intuition is inevitably a part of the decision-making process that problem-solvers can either rely heavily on, choose to suppress, or a combination thereof. Intuition helps illuminate thought and emotion when operating in volatile, uncertain, complex, and ambiguous (VUCA) environments. However, we live in a highly analytical, scientific, process-oriented, and data-reliant world that frequently subdues gut feeling and intuition. Intuition can be defined as "a highly complex and highly developed form of reasoning that is based on years of experience and learning, and on facts, patterns, concepts, procedures and abstractions stored in one's head" (Matzler, Bailom, & Mooradian, 2007). Intuition decision-making can then be defined as "affectively-charged judgements that arise through rapid, non-conscious, and holistic associations" (Dane, Rockmann, & Pratt, 2009, p. 188). Intuitive decision-making is a right-brain activity that places more emphasis on feeling and emotion, instead of on process and data (Sauter, 1999). Analytical decision-making, on the other hand, is a left-brain activity and a more rational model that "consists of identifying and assessing decision-relevant information, evaluating costs and benefits, and ultimately making a decision through deliberation" (Dane et al., 2009, p. 188). An environment promoting rapid decision-making tends to be more conducive to intuitive decision-making, whereas a slow decision-making environment tends to be more conducive to analytical decision-making.

Several factors influence the cultivation of intuitive decision-making. First, experience, age, and education have a drastic impact on the use and effectiveness of intuition. The longer a person lives, the more experiences a person has; the more experiences a person has, the more patterns a person observes; the more patterns a person observes, the better the intuition (Matzler et al., 2007). Those with a wealth of experience are "well equipped to capitalize on the potential benefits of intuition because they possess rich bodies of domain knowledge that foster the rapid and sophisticated associative processes that produce accurate intuitions" (Matzler et al., 2007). On the other hand, those with a novice level of knowledge and expertise are ill-suited to rely on the intuitive decision-making process and more likely to make misjudgments (Matzler et al., 2007). Research suggests that it takes roughly 10 years to acquire what experts call "domain-specific expertise" to develop accurate intuitive judgments (Locke, 2015). However, studies have also proven that those with even a moderate level of domain expertise possess better intuitive decision-making skills when solving unconstructed problems than those who are novices (Dane et al., 2009).

Effective intuitive decision-making is also heavily influenced by the virtue of emotional intelligence. Emotional intelligence allows individuals to recognize, understand, and weaponize emotions to gain a competitive advantage and shape decision outcomes (Matzler et al., 2007). Those who have achieved domain expertise are typically more emotionally intelligent and willing to accept and mitigate risk (Matzler et al., 2007). Knowing when to rely on intuition and assume risk requires a comprehension of both the positive and negative impacts of the decision. Neuroscientist Joseph LeDoux "has proven that the amygdala—site in the brain of emotional memory—categorizes stimuli and triggers behavior faster than cognitive process" (Matzler et al., 2007). Because emotions are processed faster than rational thought, cognitive discipline and patience are imperative when making intuitive decisions (Matzler et al., 2007). Emotional intelligence also helps establish decision risk tolerance. Peter Drucker once stated, "I believe in intuition only if you discipline it. The 'hunch' artists, the ones who make a diagnosis but don't check it out with facts, with what they observe, are the ones who kill businesses" (Matzler et al., 2007).

Not only do factors such as experience, age, and emotional intelligence cultivate the use of intuition, but so too does the type of environment and decision being made.

Intuitive decision-making is more suitable when used in a time-constrained environment because it is a faster process than conducting detailed analysis (Locke, 2015). Analytical decision-making, on the other hand, is slower and more deliberate, requiring more time for in-depth analysis. In addition, intuitive decision-making is more suitable when used to solve unstructured problems (Locke, 2015). Unstructured problems "lack clear decision rules or [have] few objective criteria with which to make the decision" (Locke, 2015). These types of problems cannot be objectively solved using empirical processes and analytical data. On the other hand, a structured problem, such as a math problem, can be logically solved and verified for accuracy using an ordered process (Locke, 2015). Although not all decisions are purely analytical or intuitive,

> if there are clear decision rules that can be assessed with an algorithm, if relevant data are not available, and if the decision will be assessed with purely objective criteria (i.e., not aesthetic judgments or feelings), then an analytical approach is likely to be more helpful than intuition in reaching the best decision. (Locke, 2015)

Intuition is less useful in solving structured problems and more useful when leveraged in unstructured environments.

Leaders in all professions are expected to make informed decisions for the betterment of their organization. Many of the decisions they make are judgment calls in which they rely on both analytical data and intuition. Seasoned leaders with a high level of domain expertise are more capable of using intuition to "demonstrate good judgment and understand that judgment is a process, not an event" (Tichy & Bennis, 2007, p. 97). Noel Tichy and Warren Bennis captured the phases of the judgment process, as shown in Figure 3. Intuition is interwoven in the judgment process, which is conducted in three phases: the preparation phase, the call phase, and the execution phase (Tichy & Bennis, 2007). The preparation phase for making judgment calls is characterized by a leader's ability to sense, frame, and align stakeholders (Tichy & Bennis, 2007). Intuition is best leveraged in this phase. Leaders with a high level of domain expertise rely on their experience and intuition to skillfully turn crisis into opportunity (Tichy & Bennis, 2007). As the decision-maker is sensing the environment, they are using their intuition to better understand their environment, identify the problem, and shape positive outcomes (Tichy & Bennis, 2007). As Tichy and Bennis (2007) noted, "Good leaders make a habit of sensing, framing, and

aligning so that they are prepared for the call, which can arise at any moment" (p. 99). Vital to this process is using intuition based on domain expertise to influence the probability of a favorable outcome. The dichotomy between intuitive decision-making and analytical decision-making is further discussed in the next section where the Dual Process Theory is introduced.

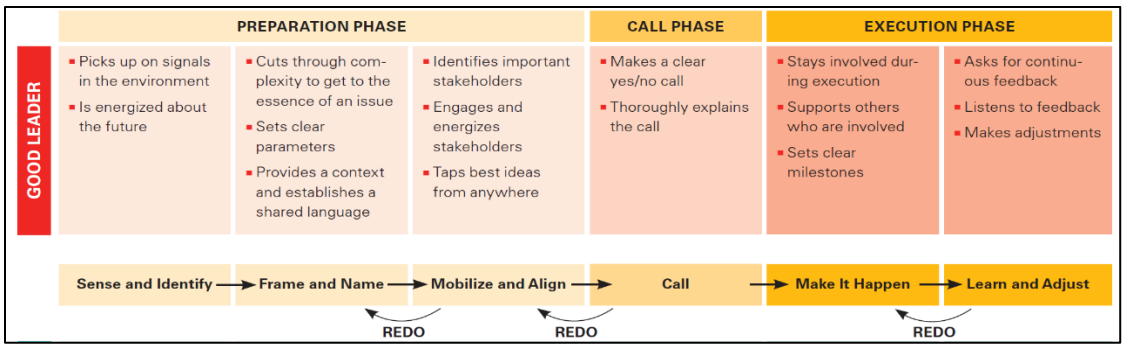


Figure 3. Judgment Process. Source: Tichy and Bennis (2007).

## F. DUAL PROCESS THEORY

Program managers make hundreds of decisions each day ranging from simple to complex. The different cognitive processes used to make fast or slow decisions has been studied by psychologists for years. The dual process theory suggests that humans use two distinct and competing processes of thinking when making decisions. Psychologists Keith Stanovich and Richard West refer to these as System 1 and System 2 (Kahneman, 2012). System 1 relies more on emotion and is considered intuitive, whereas System 2 relies more on cognitive thought and is considered analytical and rational (Kahneman, 2012). Figure 4 highlights the dual process theory and the interaction between System 1 and System 2. Understanding this topic is critical to our research because it will allow us to identify how program managers make decisions in the acquisition environment.

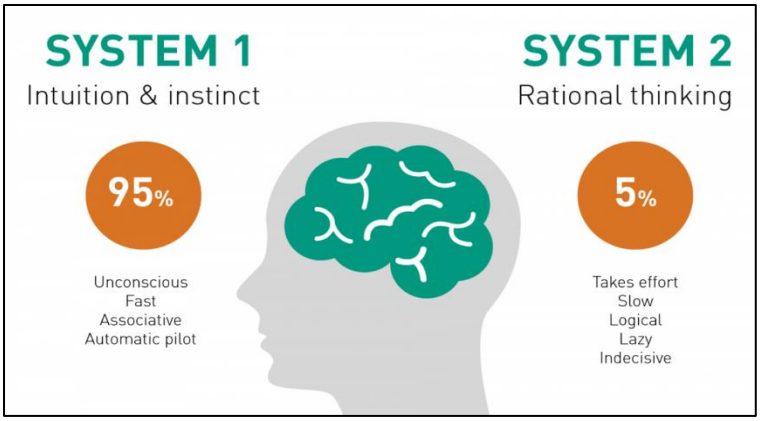


Figure 4. Dual Process Theory. Source: Kahneman (2012).

System 1 is characterized as intuitive, fast, effortless, and automatic (Kahneman, 2012). System 1 decisions rely less on cognitive thought and more on gut instinct and emotion (Kahneman, 2012). Humans rely on System 1 to make simple decisions each day. For example, we use System 1 to decide what to eat, what to wear, and what route to drive to our place of work. The decisions made are generally less complex and unstructured. According to Kahneman (2012), System 1 "*effortlessly originates impressions and feelings that are the main sources of the explicit beliefs and deliberate choices of System 2*" (p. 122).

System 2 is characterized as deliberate, slow, analytical, and voluntary (Kahneman, 2012). This system operates in a sequential manner and is known to be rational (Kahneman, 2012). System 2 is primarily used to solve complex structured problems, such as math equations, that are rule-based. To solve such issues, more time is required than with System 1. According to Kahneman (2012), System 2 "is *the conscious, reasoning self that has beliefs, makes choices and decides what to think about and what to do*" (p. 122). Understanding the difference between System 1 and System 2 will help us understand the cognitive process of NDM. In the following sections, we examine the NDM process and different approaches to understanding how individuals use intuition to solve complex problems.

## G. NATURALISTIC DECISION-MAKING

Understanding how program managers make decisions based on sensemaking or intuition when faced with complex problems is significant to our research. Secondly, being able to identify the many naturalistic environments that affect the acquisition decision-making process will further shape our interpretation of program manager's decision process. NDM is the cognitive ethnographic understanding of how people make decisions in a real-world setting (Klein, 2008). NDM research begun in the early 1980s, where studies focused on a certain population of leaders ranging from firefighters, military commanders, nurses, design engineers, and pilots (Klein, 2016). The study examined the kinds of decisions and problem sets leaders were faced with within their own career fields and how they used their past experiences to manage challenging conditions. These challenging conditions consisted of wicked problem sets like time pressure, uncertainty, conflicting goals, experience, high stakes, multiple players, dynamic settings, and organizational constraints (Klein, 2016). Understanding how each variable can affect one's cognitive ability to rapidly categorize ill-defined problems and make an effective decision is an important factor in understanding the NDM framework (Klein, 2008). Figure 5 provides a summary of the characteristics of naturalistic environments.

*Table 1. A Summary of the Characteristics of Naturalistic Environments*

- *uncertain, ambiguous or missing data* - data may even be incorrect or conflicting.
- *Ill-defined and ill-structured goals and tasks*
- *shifting and competing goals* - situation is rarely dominated by single, well understood goals, instead goals may be ill-defined, incompatible and dynamic
- *uncertain, dynamic environments* - situations are not static, straightforward or unambiguous
- *action/feedback loops* - a series of events and decisions will alter subsequent goals and actions
- *time pressure* - leads to decision making involving heuristics, biases and cognitive shortcuts. Aircraft may travel over 15km in 1 min, thus time is crucial
- *high stakes and risks* - consequences of error are high, even to the point of life/death
- *multiple players and teams* - many aircraft have 2 or 3 pilots, as well as engineers and flight attendants, in addition to ATC, other aircraft, and ground staff to be considered
- *organisational goals and norms* - the overall mission statement or goals of organisations exert pressure that may conflict and bias the situation
- *experienced decision makers* - novices are rarely studied in NDM, as most professionals are experienced or intermediates.

Figure 5. Characteristics of Naturalistic Environments.
Source: Simpson (2001).

## H. CHARACTERISTICS OF NATURALISTIC DECISION-MAKING

Time pressure can be defined as a psychological stress that occurs when an individual is faced with less time than necessary to complete a task (Davis, 2016). Time pressures are divided into two categories, low time pressures and high time pressures (Davis, 2016). Low time pressures require less demand for an individual to make a rapid decision. The individual faced with making either a simple or complex decision is operating in a more controlled environment where time is readily available for a leader to mentally process different courses of action. Though low time pressure allows for more flexibility when dealing with problems, it becomes extremely difficult when handling rapidly changing conditions (Klein & Klinger, 2015). High time pressures are more rigid, less flexible conditions that usually are not conducive to group-type thinking or course of action development due to time constraints. Military leaders, especially special forces types, operate regularly within high time–pressured environments. Environments that are

high pressured usually require a rapid decision response and are complex and difficult to categorize.

Uncertainty, ambiguity, and missing data are all contributing factors that influence the NDM process (Klein & Klinger, 2015). Uncertainty or poor understanding of the problem set can introduce complexity into the decision-making process. If the situation is unfamiliar or hard to define, the individual is forced to reassess and seek more information (Klein & Klinger, 2015). From a program manager's perspective, informational delays not only impact the ability to implement a decision, but could also negatively affect the cost, schedule, and performance of a military system. Another example that could lead to ambiguity or confusion is the shifting or competing of other goals (Klein & Klinger, 2015).

The need to accomplish competing goals puts pressure on the individual and organization to balance which decision or action is best to implement (Stroh, 2018). According to D. P. Stroh (2018), an expert in systems thinking, it is impossible to satisfy both goals at once, and if attempted, the organization will achieve one objective at the expense of the other. Trying to achieve both goals simultaneously can be difficult and counterproductive (Stroh, 2018). The end results can include poor productivity, miscommunication, resource abuse, and a decision that could produce a failed outcome.

One's experience can influence their ability to handle complex situations and make rapid decisions. Klein's (2008) research on NDM discovered that people tend to rely on prior experiences to rapidly categorize situations. The experienced decision-maker's outcomes are still successful only if they choose their first course of action (Klein, 1993). His research identified the notion that individuals go through some kind of synthesis of their experiences to make sense of complex situations (Klein, 2008). The idea that decision-making falls under a domain-independent approach quickly transitions to a knowledge-based approach that supports one's experience (Klein, 2008). From this knowledge-based approach, the decision-making process would incorporate a new model that would help further define how an individual's ability to relate back to a prior experience was based on perception and recognition of patterns (Klein, 2008). The recognition-primed decision (RPD) model illustrates how people can use their experience to identify patterns when

making a decision (Klein, 2008). Once patterns are identified, the individual can formulate a response by analyzing past experiences or lessons learned.

Organizational constraints are a significant contributing element for introducing conflict into a recognitional decision strategist (RDS) environment. Organizational aspirations may complicate the decision-making process (Simpson, 2001). By creating constraints due to organizational policies, stakeholder management, or competing goals, the RDS's decision-making process becomes limited. Organizational constraints in the work environment can also hinder an individual's ability to be creative or flexible during the decision-making process. These constraints are usually based on how the decision-making process is disrupted or shaped by either the organization's culture or needs. In the next section, we provide an overview of the organizational decision-making process.

## I. ORGANIZATIONAL DECISION-MAKING

Understanding how organizational constraints can impact the program manager's decision-making process is vital to our research. Organizational decision-making is another process that each program manager must comprehend in order to be successful within the current acquisition environment. Organizational decision-making is the cognitive process where an individual is confronted with either a programmed or non-programmed decision that has some form of effect within their organization. Both programmed and non-programmed decisions are critical factors that influence the organizational decision-making environment. Programmed decisions are highly repetitive, simple routine approaches to solving issues, while non-programmed decisions are severely complex or unique with no specific method for determining an approach to the solution (Woehrle, 2011). Carnegie, incremental, and garbage can models accurately illustrate the sequence of events when the individual is subjected to both organizational programmed and non-programmed decisions.

The Carnegie model was developed by Richard Cyert, James March, and Herbert Simon, all from Carnegie Mellon University (Daft, 2010). The model was designed to explain how the bounded rationality approach affects the individual during the organizational decision-making process (Daft, 2010). Bounded rationality is tied to limited understanding or mental capacity to process complex information or problem sets. The

Carnegie model takes in consideration of uncertainty and conflict to create a course of action during non-programmed decisions with both political and social factors (Daft, 2010).

The incremental decision-making model was developed by Henry Mintzberg and associates at McGill University (Daft, 2010). The model would support a structured sequence of events from identifying one issue to creating a single solution to implement (Daft, 2010). The incremental model is a simplistic approach to handling both programmed and non-programmed decisions without adding political or social factors that are similar to the Carnegie model (Daft, 2010). The incremental approach is designed for decision-making traceability back to the recognition of the problem to help identify what steps were taken for course of action development (Daft, 2010).

The garbage can model is unlike both the Carnegie and incremental decision models because it accounts for multiple variables that influence the decision-making process. The garbage can model deals with multiple decisions within a particular organization during moments of high uncertainty (Daft, 2010). The model supports the theory that decisions in large organizations can become erratic and spontaneous, creating a non-programmed decision-making environment (Daft, 2010). The garbage can model has relevance within the DoD and must be strongly considered when analyzing robust organizations during the decision-making process. In the next section, Klein's RPD model is explored in more depth. Klein's RPD model introduces a few organizational decision-making elements to illustrate how a certain institution can create expectations or goals that can potentially alter one's ability to implement action.

## J. KLEIN'S RPD MODEL

As previously noted, the purpose of the RPD model is to explain how rapid decisions are made in a complex environment (Klein, 1993). Figure 6 explains the mental sequence of decision-making because of an ill-defined problem set. The first step of the process is pattern analysis recognition by using past experiences to bridge relevant cues, goals, and expectancies. The second step is formulating actions off those recognition patterns that will help transition to mental simulation of what actions need to take place. The third step is using intuition and experience to determine whether the selected course

of action will be effective. The final step is implementation of the decision. The RPD Model illustrates how an individual can make a decision based off a single course of action through mental simulation (Klein, 1993). It is not intended to work for everyone though; the model seems to work best with decision-makers who are accustomed to operating in high time pressures associated with complex environments (Klein, 1993). Therefore, the RPD model can support recognitional decision strategists (RDS) who are familiar with managing dynamic operational environments (Klein, 1993). Unlike Klein's RPD model, Rasmussen's theory on decision-making focuses on addressing the different environments that can influence an individual's approach to solving problems. Rasmussen's decision process is discussed in more depth in the next section.

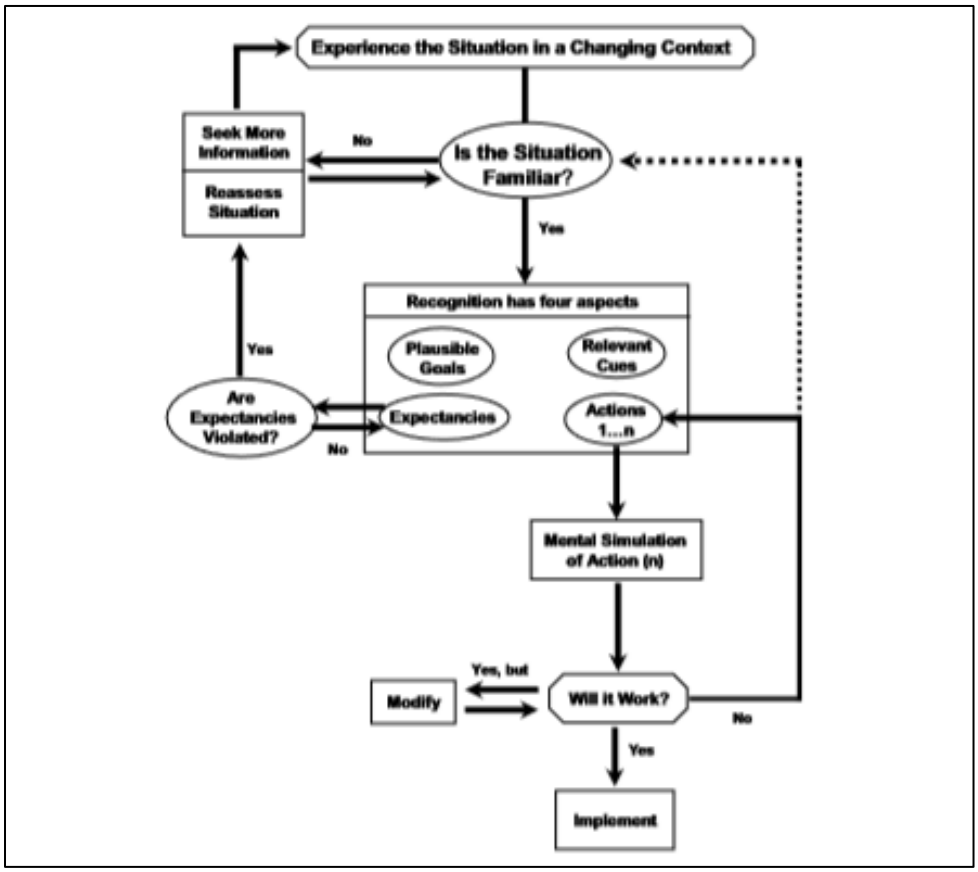


Figure 6. Klein's RPD Model. Source: Klein (1993).

## K. RASMUSSEN'S DECISION PROCESSES

Rasmussen's theory on human performance explains the decision-making process in both routine and unfamiliar task environments (Rasmussen, 1983). He categorizes human performance into three types of behavior: skill-based, rule-based, and knowledge-based (Rasmussen, 1983).

Skill-based behavior is associated with routine tasks that are simple or perceived as "second-natured" events that is supported by sensory-motor performance (Rasmussen, 1983). All skill-based behaviors are subconscious efforts to make sense or navigate through the decision-making environment. An example would be breathing or any other human activity that requires no conscious attention or control (Rasmussen, 1983). Skill-based behaviors can easily transition to actions with minimal thought or pattern recognition.

Rule-based behavior is controlled by a well-known procedure or policy that has been derived from a previous occasion or an event (Rasmussen, 1983). This type of behavior is commonly seen in familiar work environments where the individual is confident and understands the problem set. An example would be a program manager adhering to the DoD Instruction 5000.2, the program manager's acquisition guidebook for all program-related decisions. The transition from rule-based behavior into skill-based behavior will be dependent on a person's level of training and attention to mastering their craft.

Knowledge-based environments fall under unfamiliar decision-making environments where skill-based and rule-based behaviors do not apply (Rasmussen, 1983). The goal for knowledge-based environments is to make sense of ill-problem sets that will later aid course of action development. A lot of the "mental" actions are tested through trial and error until there is a solid understanding of what the outcomes of the decision will be (Rasmussen, 1983). Examples of knowledge-based environments will all depend on the tacit knowledge and expertise of the individual undergoing the decision-making process.

## L. CHAPTER SUMMARY

This chapter summarized a variety of relevant literature written about decision-making, specifically, individual and organizational decision-making. The purpose of the

chapter was to provide a baseline review of literature written on the topic and not an exhaustive review. It highlighted several decision-making and sensemaking models developed by some of the world's most well-known psychologists. Chapter III illuminates the data, facts, and findings from our research with two ACAT I Army program managers.

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# III. DATA

## A. CHAPTER OVERVIEW

The purpose of this chapter is to disclose the results of the data collected during our research. On August 10, 2018, we interviewed two Army program managers in the rank of colonel, both of whom manage Acquisition Category 1 (ACAT 1) programs in Huntsville, AL. The purpose remained to recognize how a program manager gains insight into the decision-making process in complex and sometimes chaotic environments. For the sake of safeguarding personally identifiable information, the interviewees' names and acquisition program are not revealed in this summary. We refer to the first interviewee as "Subject A" and the second interviewee as "Subject B." We refer to their programs simply as ACAT 1 programs. Both interviews were digitally recorded and transcribed for ease of analysis by the research team. Figure 7 provides an upfront snapshot of the analytic codes and categories that were derived from the data gathered from both subjects. As themes began to emerge throughout the interviews, they were put into the 21 second-order analytic codes and later categorized into six aggregate categories displayed in Figure 7. This chapter reveals the results of that coding and categorization.

| Analytic Code | Category | Application |
|---|---|---|
| Pattern Recognition | Sensemaking | Art |
| Organization | | |
| Simplification | | |
| Prioritization | | |
| Stakeholder Alignment | Consensus-making | |
| Education | | |
| Showcase | | |
| Synchronize | | |
| Transparency | Trust | |
| Reliability | | |
| Credibility | | |
| Empowerment | | |
| Experience | Tacit Knowledge | Skill |
| Creativity | | |
| Cognitive Ability | | |
| Data | Explicit Knowledge | Science |
| Process | | |
| Policy | | |
| Budget | Environment | Constraints |
| Requirements | | |
| Operational Culture | | |

Figure 7. Analytic Codes, Categories, and Applications

## B. SUBJECT A—INTERVIEW SUMMARY

On August 10, 2018, we conducted an interview with Subject A, who is a program manager for an Army Category 1D program, which exceeds $480 million in research, development, technology, and engineering (RDT&E) and $2.79 billion in procurement throughout the system's life-cycle cost. We asked Subject A to explain a time when his program experienced difficulty and to tell us a story about how he dealt with such issues. We also asked Subject A to frame the current acquisition environment and how he gains insight into the decision-making process when dealing with complex situations. The questions we asked were intentionally open-ended, allowing the subject to describe and explain his decision-making process from his individual experience. What we discovered were certain trends associated with both analytical and naturalistic decision-making principles.

Figure 8 depicts the analytic codes that formed the basis for the aggregate categories based on the data gathered from Subject A. The analytic codes were established from information themes discussed by Subject A during the interview process. Figure 9 depicts the number of times Subject A referred to a specific category. The data shows that environmental factors and consensus-making had the most influence on Subject A's decision-making process. Sensemaking, trust, and tacit knowledge were virtually equal, while explicit knowledge was the least occurring factor impacting Subject A's decision-making process. This data is further extrapolated in the next several paragraphs.

| *Analytic Code* | *Category* |
|---|---|
| Pattern Recognition | Sensemaking |
| Organization | |
| Simplification | |
| Prioritization | |
| Stakeholder Alignment | Consensus-making |
| Education | |
| Showcase | |
| Synchronize | |
| Transparency | Trust |
| Reliability | |
| Credibility | |
| Empowerment | |
| Experience | Tacit Knowledge |
| Creativity | |
| Cognitive Ability | |
| Data | Explicit Knowledge |
| Process | |
| Policy | |
| Budget | Environment |
| Requirements | |
| Operational Culture | |

Figure 8. Subject A Analytic Codes and Categories

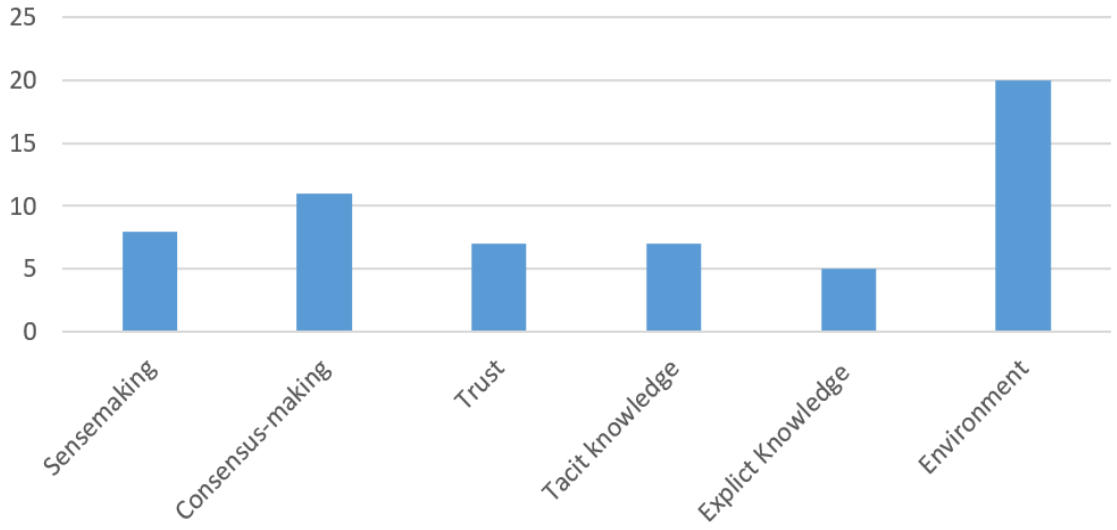


Figure 9. Subject A Categorical Interview Data

### 1. Sensemaking

Subject A referred to sensemaking eight times during the interview. The analytic codes derived from Subject A that form the category sensemaking include pattern recognition, prioritization, and organization. Subject A described the evolution of his current program, stating that it had been "basically an 18-year developmental program." Subject A referred to his program in this manner because the program had been cancelled, renamed, and reinitiated several times over the course of nearly two decades. Subject A was very introspective during the interview and demonstrated a keen awareness of past programmatic patterns and highlighted the importance of such patterns to make future programmatic decisions. Subject A described signs and symptoms of potential future programmatic difficulties. Based on intuition and past experiences, Subject A was able to sense potential issues early by understanding patterns and organizing the information to shape future decision-making. Subject A stated,

> *I think a lot of where I saw potential disconnects were gut feeling where you had experiences that told you that okay, if they are asking me what would happen if we slip this another three or four months, or if I cut you a little bit, what would the impact be?* I used to refer to it as you give a program cancer. That's when you see the budget guys looking for something, they start to nibble at it, and they give the program cancer and it just takes a slow,

> slow death to finally happen. When you start seeing that, you have got to force it to make the decision.

When program funding was cut or when the requirement changed, Subject A organized the data and solved the problem by setting new priorities with the user community, given new constraints. Subject A stated,

> *You prioritize with the user community and then we'll work with them to understand what the cost associated with the different gaps that they want to pursue, what they are, and how they want to prioritize them.* So, we're really impartial to who gives us a requirement and who gives us the money, as long as I get both, I can go do what we need to do.

Subject A's reference to using his gut feeling, his reference to organization and pattern recognition, and his reference to prioritization became analytic codes that formed the sensemaking category.

### 2. Consensus-Making

During the interview, Subject A referred to consensus-making 11 times. The analytic codes derived from Subject A that form the category of consensus-making include stakeholder alignment, education, and synchronization. Subject A thoroughly described the importance of stakeholder management and stakeholder alignment. In the process, Subject A shared an analogy of the DoD acquisition process that he labeled as the "bus driver theory":

> I had a great boss … and she had an analogy of acquisition being a school bus and it's a unique school bus where there's one driver that had the steering wheel and that was the PM, but everybody in the back of the bus had a brake, and so you get that visual that everybody can stop you, and yet you're the one stuck driving this thing, and that's the decision-making process—*good explanation of the decision-making process because you've got to get them all on board.*

The bus driver theory concisely summarizes the importance of identifying key stakeholders, managing stakeholder perception of the program, and creating shared understanding among stakeholders. Subject A's reference to getting everyone on board was coded as stakeholder alignment and easily fits into the consensus-making category.

Subject A continued the discussion on stakeholder management and alignment by stressing the importance of consensus-making. It is the job of the program manager to champion his or her program from the day the charter is assumed to the day the charter is passed on. In the process, the program manager must influence stakeholder perception of the program. Influencing decisions as an acquisition professional means synchronizing perceptions of senior leaders and the ground user alike. Subject A stated,

> Regardless of whether you're out in a company, battalion, brigade, or you're in acquisition job here working through to the Army staff and through ASALT, the higher you get in grade, the less direct influence you have over the people who work for you. That's particularly our case in acquisition because our direct chain and our influence is very, very narrow, but it goes all the way from the top of the senior leadership of the Army, down to, you know, where the rubber meets the road with the warfighter, but it's in a very narrow band. *Knowing when to get the stakeholders involved at the different levels is the part that I think, you know, I fell back on when I decide, hey, this is where we need to kind of get into some decision-making process of who we need to engage, because we do have the ability to affect, or have access to people at the very, very top because we're always getting asked to come in there, and that's who holds the decisions for us to move forward.* Every budget decision, you know, the secretary and the chief are the only ones that really approve budget decisions for the Army.

Subject A's reference to knowing when to get stakeholders involved and his reference to the narrowness of the chain of command were coded as stakeholder alignment and synchronization, both of which fit easily in the consensus-making category.

Subject A described the importance and uniqueness of stakeholder alignment and consensus-making in the acquisition environment. He described how decision-making in the acquisition environment is very different from the operational environment because of decision-making authority. As he alluded to in his earlier statement, Subject A described the difficulty in synchronizing efforts due to the narrowness of the chain of command. Subject A stated,

> *The actual execution of getting stakeholder … consensus on decisions, that's something that is a little bit different than I think the way you would see operational decisions being made.* Most of our experiences in the operational Army, we have a little bit more direct authority and we could force decisions and quite honestly, we know all of the factors at those levels that we are capable of making those decisions. A lot of our decisions in acquisition are so complex because of the narrowness of our chain of

command and because top line Army decisions may impact what you are doing.

Subject A's reference to the narrowness of the chain of command once again highlights the importance of stakeholder alignment and the synchronization of stakeholders for the overall success of acquisition programs.

Subject A described the art and science of program management. In doing so, he described the acquisition process as the science, and activities such as stakeholder management, the art. Subject A stated,

> *I think process is the science behind how we do it. The art is in how you deal with those stakeholders to get it through*. I think that's where the gut feeling of who you need to get influenced—again with our structure, we can steamroll people just because we quickly go to the top. The other part is we can quickly get steamrolled. So, you have got to be careful in how you play that card.

Subject A described one of the roles of the program manager, which is educator. Subject A explained that the program manager must educate decision-makers on risk areas and how they impact cost, schedule, and performance. Subject A stated,

> If they are doubting the requirement … *I think that is when you need to push, are you sure you understand fully where this thing fits into the Army doctrine?* If they say, yes, we got it, we understand what not doing this program will do, or we know what you know, slowing it down will do based off of threat evolution and threat vectors and they are willing to accept that, then it's an informed decision, go home, sleep well at night. *If you haven't done the right job of going and informing those folks and they make an uninformed decision,* then a year later they come back and say, wait a minute, you didn't tell me about this impact, well—sorry."

Subject A's reference to informing was coded as educating and fits in the category of consensus-making.

### 3. Trust

During the interview, Subject A referred to trust seven times. The analytic codes derived from Subject A that form the category trust include reliability, credibility, and empowerment. As described earlier, several stakeholders have influence over DoD acquisition programs. It is the program manager's responsibility to manage cost, schedule,

and performance of acquisition programs in order to provide the warfighter with the best instruments of war. Accomplishing such a task requires trust among stakeholders, empowerment of acquisition professionals to make decisions, and credibility and reliability of all leaders influencing the program. During the interview, Subject A hinted at there being a lack of trust between DoD program managers and the MDAP decision-makers. Subject A stated,

> When the Army sets a priority and is committed to something, if you get behind, our natural instinct is to question why you're behind and to potentially raid that program, because we smell blood in the water and everybody wants to take the funds from it, rather than say, hey, you're behind, we need to apply more resources, we need to fix the problem because this is an Army priority. We shouldn't club the guy while he's down, but fix it. When the bus gets a flat tire, change the tire and keep moving, but don't look for a new bus, and that's what we've historically done with a lot of our programs.

Subject A's reference to clubbing while down, fixing the flat tire on the bus, and raiding a program of funds implies that there is a lack of trust and empowerment between the program manager and the operational force and decision-makers that needs to be changed.

The Army must trust the program manager to make programmatic decisions, but often, program managers spend more time educating, aligning, and managing stakeholders. Once a requirement is set, and resources are allocated, the program manager must display competence in program execution, must be given trust and responsibility to lead, and must be supported by leadership in order to succeed. However, decision-making authority is held at the highest levels with the DoD and is out of the program manager's hands. Subject A illuminated trust, credibility, and micro-management issues in the following statement:

> You [the user] own the requirements, you tell me what you want me to go get you, and I will get it for you. I am not married to it, but if you start seeing them poke around asking questions from different perspectives, it probably means that they are doubting the requirement. Or the priority of the requirement in the big scheme of things.

Remaining neutral to requirements allows the program manager to separate emotions from management and better influence decisions on cost, schedule, and performance. Subject A explained the importance of the charter when making complex

decision that impact multi-service programs. He also highlighted the importance of trust in the acquisition process when he referenced a handshake deal with the Army or other services. Subject A stated,

> The decision-making process has to be rooted in whatever your charter is. So, if you've got a charter that says I'm going to execute this program, and I've got an acquisition program baseline that I've said I need this much money to deliver this capability whenever that is changed, whether it's you screwed up the acquisitions strategy and, you know, you're behind schedule and you're over budget, or they want to change something on there, *that is your handshake with the Army, and potentially other services* if you've got a program like some of mine that are multi-service. That's when you have to get into that, okay, now what is the way to get us back out of this hole and when do I need to ask for help.

#### 4. Tacit Knowledge

Subject A referred to tacit knowledge seven times during the interview. The analytic codes derived from Subject A that form the category tacit knowledge include experience, creativity, and cognitive ability. Subject A demonstrated a reliance on his past experiences in acquisition to shape future decision-making. Subject A referenced his experience in acquisition by highlighting that he has over a decade of experience in the field. He referenced how experience, creativity and cognitive ability were important by stating,

> I think a lot of understanding where I saw potential disconnects were gut feelings where I had experiences that told me that if they are asking me what would happen if we slip this another three or four months, or if I cut you a little bit, what would the impact be?

Subject A's reference to utilizing his gut feeling to understand potential disconnects, his reference to his experience, and his reference to providing counsel based on changes to resources or requirements were coded as experience and cognitive ability and categorized under tacit knowledge.

Subject A further explained why tacit knowledge was important to gain insight into the decision-making process. Subject A explained how tacit knowledge and past experience help a program manager identify key stakeholders to engage. Subject A stated, *"Knowing when to get the stakeholders involved at the different levels is what I fell back*

*on when we needed to get into the decision-making."* This statement was coded as experience and creativity and falls into the tacit knowledge category.

Subject A contradicted the importance of tacit knowledge and past experiences when he stated, "*Your experiences don't necessarily prepare you 100% for how to best get things done."* However, in making this statement, Subject A was referring to the difficulties of consensus-making and how past experiences don't prepare program managers for this process. In addition, Subject A stated that the higher leaders get in grade, the less direct influence they have over the people who work for them.

### 5. Explicit Knowledge

During the interview, Subject A referred to explicit knowledge five times. The analytic codes derived from Subject A that form the category of explicit knowledge include data, process, and policy. *Data* refers to specific information, figures, or statistics, such as test and evaluation criteria, used in program management to make decisions. *Process* and *policy* refer to the defense acquisition systems and the laws, rules, and regulations associated with acquisition. Subject A explained the difference between "big A" and "little A" acquisition. He stated,

> As soon as you sign up as a product manager, to program manager, to take some amount of resources, to deliver some amount of capability, *then it becomes a "little A" problem, and think that's where we struggle with pushing back on the requirements or the resourcing folks to make sure that when we do take ownership of that, we can execute it.*

When subject A referred to "little A" acquisition, he was referring to the processes and policies associated with program management. This was coded as policy and process and falls under the category of explicit knowledge.

Subject A went on to describe the defense acquisition management system (DAMS) and how it impacts the program manager's ability to make decisions. The DAMS is a process characterized by a series of processes, events, and milestone decisions to manage the life cycle of future and emerging systems. Subject A stated,

> *We only have got one process. You can hate the process all you want, but it's the one we got, and there's ways to make it work.* So, you will see a couple of different camps of acquisition guys. Those that will just complain

> about the process and try to, you know, use it as a scapegoat for why things are going slow or why they can or can't do things. *Then, there are others that try to work with it and do the best they can.*

Subject A's reference to the process and his reference to those who work within the process and make the most out of it were coded as process and policy. We believe that when Subject A referred to working within the system that he meant staying legally adherent but navigating the rules to provide the best capability quickly.

### 6. Environmental Factors

During the interview, Subject A referred to environmental factors 20 times. The analytic codes derived from Subject A that form the environmental category include the budget, requirements, and operational culture. This was by far the most referred-to category during the interview with Subject A and is an essential element that merits research to fully understand how a program manager gains insight into the decision-making process. When describing the biggest challenges he has faced, Subject A described how the budget and requirements impact the acquisition environment. He stated,

> The biggest challenge I think that any acquisition manager is going to run in to, is we aren't going to have consistent budgeting, we aren't going to have stable funding profiles, and we're always going to have a user with an insatiable appetite for new requirements, and that's fine, but when you make that handshake agreement with them, that, hey, I'm going to deliver this product, you then can't let them change the funding or the requirements without getting their buy-in on the impact to program.

Subject A reiterated the fact that program managers must remain impartial to requirements. Subject A describes how his current program has been impacted by environmental factors. He stated that *his program experienced funding cuts and cancellation* over the past 18 years because of *presidential budget decision 753, the focus on counterinsurgency and changing requirements and because of sequester*. Subject A describes the profound impact of environmental issues by stating,

> We finished up the program that we had started 18 years ago this past spring, and it's an incredible capability to give to the war fighter, but if we stayed the course early on and provided that consistency, we likely would've finished it well ahead of time, and probably a lot cheaper than the full program costs us today.

Subject A went on to describe the pressure that program managers face when influencing complex decisions. Subject A described how it is difficult to empower acquisition professionals and how at times, acquisition professionals are reluctant to accept empowerment when it is presented to them. Subject A described the struggle between leadership and charter by stating,

> It's very, very hard to empower acquisition people. Acquisition people were very reluctant to accept empowerment or take that and say okay, I have got a charter, I am going to go and make these decisions. We all talk a tough game, but when it comes to push comes to shove, am I going to not do what the PEO wants me to do? Or am I going to fall back on my charter and tell the requirements guys, no, you are not changing your requirement? I got this, I am going to go and do this. But I think ours is, because of the consensus-building part, your experiences don't necessarily prepare you 100% for how to best get that done.

Subject A alludes to the struggle between the charter and the environment. He makes it clear that at times, acquisition professionals become complacent or cede their authority by stating that it is very hard to empower them.

## C. SUBJECT B—INTERVIEW SUMMARY

We conducted an interview with Subject B who is a program manager for an Army Category 1D level program exceeding $480 million in RDT&E and $2.79 billion in procurement throughout the system's life-cycle cost. We asked Subject B to explain a time when his program experienced difficulty and to tell us a story about how he dealt with such issues. We also asked Subject B to frame the current acquisition environment and how he gains insight into the decision-making process when dealing with complex situations. The questions we asked were intentionally open-ended, allowing the subject to describe and explain his decision-making process from his individual experience. What we discovered were certain trends or patterns associated with both analytical and NDM principles.

Figure 10 depicts the analytic codes that formed the basis for the aggregate categories based on the data gathered from Subject B. Figure 11 depicts the number of times Subject B referred to a specific category. The data shows that consensus-making and environmental factors had the most influence over Subject B's decision-making process, while sensemaking, trust, and explicit knowledge were all equal but less frequent. Tacit

knowledge was the least occurring factor that affected Subject B's decision-making process.

| *Analytic Code* | *Category* |
|---|---|
| Pattern Recognition | Sensemaking |
| Organization | |
| Simplification | |
| Prioritization | |
| Stakeholder Alignment | Consensus-making |
| Education | |
| Showcase | |
| Synchronize | |
| Transparency | Trust |
| Reliability | |
| Credibility | |
| Empowerment | |
| Experience | Tacit Knowledge |
| Creativity | |
| Cognitive Ability | |
| Data | Explicit Knowledge |
| Process | |
| Policy | |
| Budget | Environment |
| Requirements | |
| Operational Culture | |

Figure 10. Subject B Analytic Codes and Categories

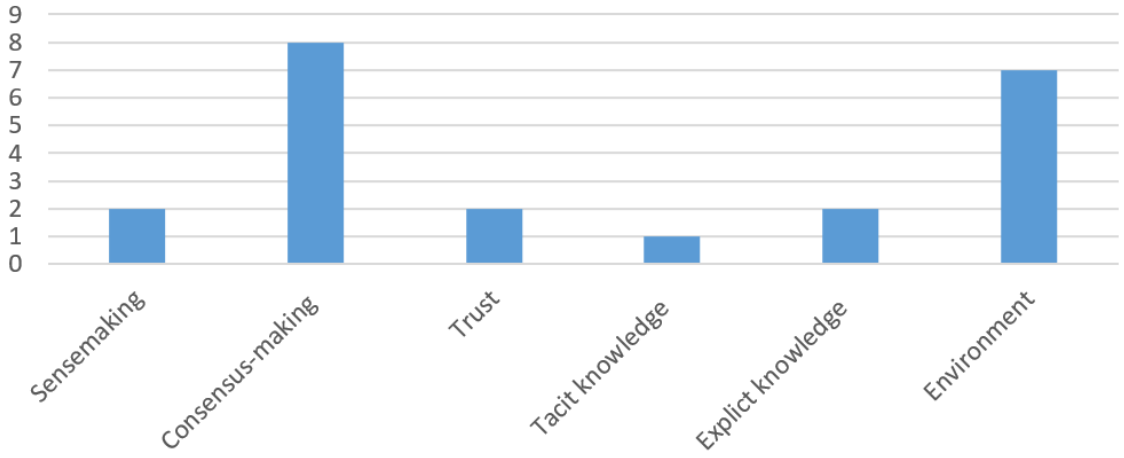


Figure 11. Subject B Categorical Interview Data

### 1. Consensus-Making

During the interview with Subject B, consensus-making elements were identified nine different times. The analytic codes derived from Subject B that form the consensus-making category include stakeholder management, educating, and showcasing. Subject B described the importance of creating a stakeholder matrix to better understand which individual can be influenced through a consensus-making approach. Subject B stated, *I'm doing it because I have no idea who my stakeholders are.* Subject B's reference to the stakeholder matrix highlight the importance of identifying stakeholders and having a plan to gain their consensus on the program when needed.

Subject B described a moment of uncertainty among several senior military leaders who articulated doubt about how the program was progressing during its early developmental stage of the life cycle. This newly discovered confusion with certain key senior military officers shaped the conditions for possible program termination. Subject B reacted to this difficult, sensitive situation by seeking out individuals who openly expressed doubt about the program and educating them on the capabilities the system would provide for the warfighter. The following quote highlights stakeholder alignment and education. Subject B explained,

> General X was swinging through Huntsville earlier this week, for the space and missile defense symposium, and he wanted an hour with each of the programs here, just to kind of understand them. And, when I sat down with him, he said, "Why on earth would you continue this contract with?" So, I knew, out of the gate, you know, where his head was at, right? *Over the course of an hour, he totally did a 180, he completely got it, he understood that if we don't do this, we're delaying this capability nine years, another $2 billion, and that the folks that are championing this, hey let's just upgrade this Patriot thing, they really don't understand the complexity involved with that, and they're getting a bill of goods from that vendor.*

> Subject B explained the importance of showcasing the system's capabilities by providing situational awareness through media sources. Every time the system went through a critical milestone, Subject B made an effort to continually build confidence with the user community. An example of this was when Subject B was describing past efforts on the Joint Air-to-Ground Missile Program (JAGM): We've done like these five soldier check out events in the last year and a half. There was some ugly, but there was also some good. Put out a couple press releases. So, they recently have done that. *We did it a lot on the program—every time we awarded something, every time we shot something, you know, hey, let's go to the press, and we'll remind them that we're still here and we're doing good stuff.*

### 2. Environment

Environmental factors were another instrumental element that impacted Subject B's decision-making process. During the course of the interview, environmental elements were discussed over seven times. The analytic codes derived from Subject B that form the environmental category consisted of budget concerns, user requirements, and the Army's organizational culture. Subject B simply explained how the budget process works and how the program manager has limited influence on the overall cost of the system. Subject B quickly referred to the acquisition budget process when stating,

> Well, cost is what it is. *You're kind of in a box, and it's hard to ask for money*. It's not impossible, I mean, we do it every fall, and anytime we've needed money, if you have support, and you have the user going, "Yeah, I need that!" you'll probably get your money.

User requirements are derived from operational gaps identified when comparing military capabilities against a well-known enemy threat. Requirements are the key essential element that the acquisition management process is built upon. Subject B alluded to this

fact when describing the important role that requirements and capability gaps play during system development. This was made evident when Subject B stated,

> So, figuring out who the stakeholders are and making sure that they understand what you're trying to say, and you're not being biased, you know, I think I opened this with, *if the requirements and the capability gaps didn't exist, then I wouldn't be championing this program*, I'd say cancel it. I mean, I'm early enough they'll find me another job, you know, I'm not worried about that.

Subject B explained the current culture within the Army and how it is impacting the decision-making process for weapon system development. Subject B talked about how a simple routine contracting modification was being stalled due to awaiting approval from a certain senior leader. Traditionally, this particular senior leader has never gotten involved in matters like system-level contracting. According to Subject B, the recent shift within the Army's culture has ignited this new drive for acquisition management—what could be considered disruptive towards the overall acquisition process.

> So, just this morning, we were in a meeting with the undersecretary of the Army asking to award a contract modification. Nothing that I would have ever have asked permission before in the past before. But the secretary of the Army himself has said that there should be no actions on that program until I approve it, so we've been pending this award of this modification since January. *I think that it's a tough environment to work in—an ACAT 1 program manager should never be waiting on the secretary of the Army who's not even anywhere in my chain to award a modification to a contractor, that I've been budgeted for, that Congress has given me the money for, that's been in all of my R forms, that type of thing.*

### 3. Sensemaking

Subject B's ability for sensemaking was a major factor that shaped the NDM process when dealing with complex problems that affected the program's progression. Throughout the interview, sensemaking elements were discussed only two times. The analytic codes derived from Subject B that form the sensemaking category include simplification of complex problems and prioritization of efforts. Subject B also referred to using "gut feelings" when making decisions, indicating that intuition was another key element in the sensemaking process.

During the interview, an analogy was used by Subject B to simplify a complex problem his organization was facing. By simplifying the problem, Subject B created an objective that can be managed and executed. This approach diminished confusion and created a unified effort within Subject B's organization. This simplification process was described when Subject B stated,

> You guys are going to be spending this week talking details about every procedure dealing with this contract, all the deliverables, you know, where we kind of disagree on this and that, the test schedule, all this stuff. *I said, let me give you a north star, that was my phrase. Forty-eight out of 48. And everybody knew exactly what I was talking about.* We were required for—to show our reliability to have 48 test shots in the EMD. We were going to shoot 48 JAGM missiles. And I said, "If you can't shoot 48, then you couldn't produce 48. So, all you production quality guys, think about 48 shots on schedule. If you can't get there without you guys doing your production quality. You software guys, you can't defeat the edge of the envelope targets that you're going to be required to test against and we're not going to get 48 out of 48 if you don't do your thing." So, you know, I could go on and on, but, *every person in that room, regardless of their discipline, was able to say, "Okay, something I'm doing, I can track right to that north star of 48 out of 48."*

Subject B talked about the importance of setting the conditions for success before entering into limited user tests (LUTs). By using past experiences, Subject B reprioritized the organization's efforts to ensure system success before interacting with the user. This reprioritization of effort was centered on maintaining a positive reputation with current stakeholders, specifically with the user. Subject B referred to this when stating,

> I've told my boss, I'm not going to LUT until I've done a force deployment exercise or I've tickled everything we're going to do in LUT, before we go to LUT, so that there's no big surprises and we're not walking out there, you know, staring through our closed fingers, with our fingers crossed hoping and praying that it goes well. And, is that going to probably cost me some schedule.

### 4. Trust

During the interview with Subject B, elements associated with trust were identified two different times. The analytic codes derived from Subject B that form the trust category include transparency among other organizations that have some form of influence over system development. Maintaining transparency was addressed by Subject B multiple times

throughout the interview. One example was when Subject B was describing maintaining transparency within the user community. Subject B explained,

> It's another problem with this program is that my user says, we have no transparency, we haven't seen anything in two years, you know, okay, my doors are open, you can come to every meeting that I have with the group. In my second week, I went out to Fort Sill, I met with the leader of the CFT, the one-star, and his colonels, and they said, *"We've been asking for this, this, and this for forever and we haven't gotten this."* Right, tell me exactly what it is, and I wrote it down, there were five things. *Within a week, I had given them three of those things, and then we had set up meetings for the other two.* Which I've since, all but one, have gone back and given it to them. *So, they can't keep coming and saying you're not transparent. If they have other biases, that's fine, but that's not one that they can keep throwing out on the table, if I'm being transparent.*

### 5. Explicit Knowledge

Elements of explicit knowledge were discussed by Subject B two times throughout the interview. Data was the major analytic code driving the program manager's explicit knowledge. Subject B expounded upon the importance of system-level testing and setting the conditions for success before entering into both developmental and operational tests. By using data, Subject B was able to make a decision based off quantitative historical facts related to system performance. This decision based on data possibly prevented system failure, protecting the program's reputation among the user community. Subject B referred to this when stating,

> *Why would you go to a test if you're not ready?* Here's what I'll say. It's because I come from the missile defense agency, where they have a very rigorous test readiness review before any test and if your confidence factors based on a gazillion (Monte Carlo) runs from all different contractors on your probability of successful intercept. *If you're not in the high 90s, you aren't taking that shot.* So, I bring the same thing to this, and it's not because it doesn't mean that we're dumb down the test. *It just means that we got to make sure that the system, whether it's the JAGM missile or this thing here, is ready to do what it's supposed to do in this test, and if it's not, we're not going to find out about it at the test*.

### 6. Tacit Knowledge

A tacit knowledge example was identified only once throughout the entire interview with Subject B. What we could derive from this one example is that Subject B's tacit

knowledge is related to past experiences as a program manager. Subject B has spent over 13 years managing and developing complex weapon systems for the Army. The years of program management experience has laid the foundation for how naturalistic decisions are currently made in an ACAT 1 program. Subject B described how he used past work experiences to shape the decision-making process:

> I started my acquisition life in a program called Future Combat Systems, which you may have heard of. I was on the Defense Contract Management Agency (DCMA) side, on the system of systems common operating environment. It was the software backbone for Future Combat Systems that was supposed to link all the hardware programs together, which is a lot, like the program I'm on right now, except for the failing part. After that, I went to Milestone Decision Authority (MDA) and worked on Terminal High Altitude Area Defense (THAD) for four years. Two years as an APM and two years as a test officer during their Engineering Manufacturing and Development (EMD) phase, Initial Operational Test and Evaluation (IOT&E), and into production. And then, I became the Joint Air to Ground Missile (JAGM) project manager. And I picked that up at the end of the Technology Maturation and Risk Reduction (TMRR) phase, we were in a competition, which was a challenge because we still had to finish TMRR with one contractor. We weren't really able to plan much for the next phase until we were able to down select, and I was the second program to ever go through an request for proposal (RFP) Defense Acquisition Board (DAB) at the ACAT 1 D level. So, took JAGM all the way through EMD, not all the way through, *I re-baselined my last year, I had—I knew I needed to re-baseline the minute that I hit the ground, and I had a chain of command that said, "Let's just wait and see," so I waited until that guy retired and then my boss and I said I got to re-baseline and he said absolutely, and the PEO supported it. We re-baselined, changed the milestone, had support from the building, and they just went through Milestone C in the month that I said they were going to be in, not because I'm any good at this, it's just sometimes things are laid out clearly and you can kind of tell how they're going to be.*

## D. CHAPTER SUMMARY

We have concluded that the data gathered from both Subject A and B interviews supports five aggregate categories within the decision-making process. Within these five categories, we were able to identify specific elements that shaped each program manager's analytical and NDM abilities. Figure 12 captures our analytic coding and categorization of the data presented in this chapter and how the five aggregate categories provide insight into how program manager makes decisions. Additionally, environmental factors such as

budget, requirements and the operational culture can affect the program manager's decision-making process. Figure 13 depicts the number of times each aggregate category was identified from both Subjects A and B.


Figure 12. Program Manager's Insight Model for Decision-Making

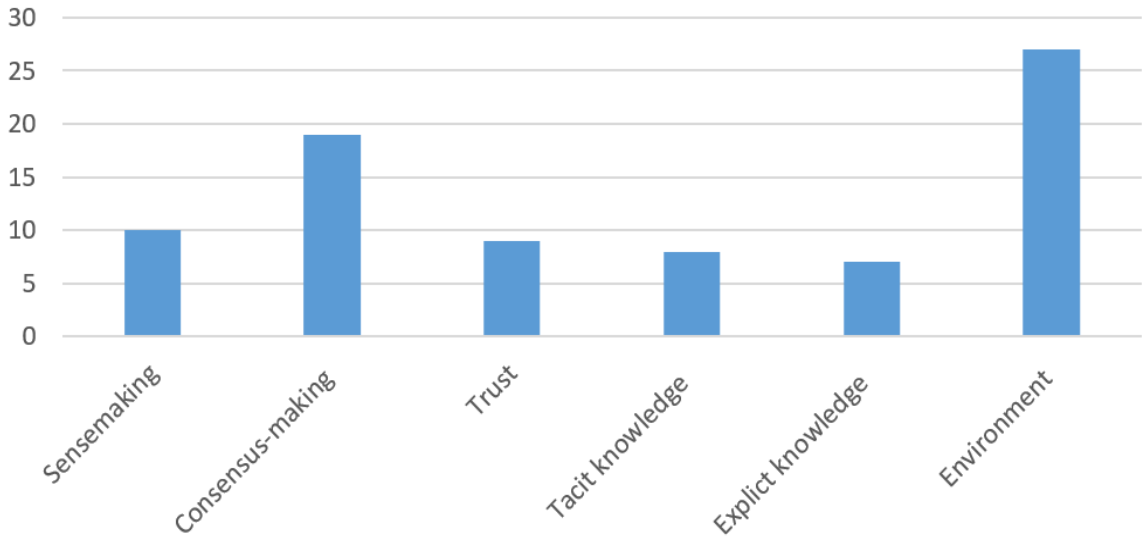


Figure 13. Consolidated Categorical Interview Data

# IV. ANALYSIS

## A. CHAPTER OVERVIEW

The previous chapter extrapolated and presented all the relevant data gathered from the interview process. This chapter presents our analysis of the factors that affect a program manager's ability to gain insight into the complex decision-making process. Our analysis is based on the data presented in Figures 12 and 13. In this chapter, we also introduce two hypotheses and theories addressing the acquisition environment and how a program manager acquires knowledge to make complex decisions.

## B. EXAMINATION

The data gathered, although limited in scope, tells a great deal about how a program manager gains insight into the decision-making process. The sheer numbers reveal that the environment has the largest impact on a program manager's ability to gain insight into the decision-making process, followed by consensus-making, sensemaking, trust, tacit knowledge, and explicit knowledge. After analyzing and examining all the data gathered during the interview process, we have come to several conclusions. Our findings are highlighted in the following paragraphs.

First of all, ACAT I program managers do not make major decisions but possess responsibility to influence the decision-making process. The data gathered suggests that ACAT I program managers do not make major system-based decisions, but rather manage the cost, schedule, and performance of a program through influencing key stakeholders and decision-making authorities. For all ACAT I programs, decision-making authority lies at the service acquisition executive or defense acquisition executive level. ACAT I program managers operate in complicated and complex environments that are muddied by personalities, competing goals, and sometimes counterproductive rules and regulations. They must understand politics, law, and the needs of several competing organizations. Above all, the program manager must remain neutral to requirements as they come from the user.

The environment described by both subjects reveals the fact that DoD program managers operate in generally ordered environments. Evidence suggests that DoD program managers operate mainly in the complicated and complex domains of the Cynefin Framework, rarely in the chaotic domain and never in a state of disorder. The decision-making process is slow, calculated, and structured in comparison to decisions that are made instantly in combat. Rarely does a program manager have to take action to restore order prior to making or influencing a decision. Both subjects identified the fact that the cause-and-effect relationship between resources and requirements is easily understood. If the program manager is provided with both resources and requirements, he could do his job. Furthermore, there is an abundance of standing operating procedures and best practices that attempt to simplify the process for the program management team. This is an attempt to pull the work of the program manager into the simple domain.

Second, evidence suggests that DoD program managers rely on a healthy dose of analytic and intuitive decision-making processes to influence MDAP decisions. Figure 14 is based on concepts from Rasmussen's decision-making process and our interpretation of how program managers make decisions within the current acquisition environment. The figure illustrates how both time pressures and problem complexity can drive an analytical or naturalistic response. In our data analysis, we found that program managers rely heavily on analytical decision-making while using NDM to manage both internal and external organizational goals. For instance, both Subject A and Subject B stated that they use an NDM process to align stakeholders rather than make decisions. Both Subject A and Subject B discussed in depth their use of intuition to determine which stakeholders to manage or acquire. Out of the eight references to intuitive decision-making, Subjects A and B both referred to using intuition to get stakeholders on board eight times. Subjects A and B referred to the analytic decision-making process 19 different times. We assess that analytic decision-making plays a larger role in influencing the decision-making process itself, whereas NDM helps program managers identify and manage stakeholder who have influence.

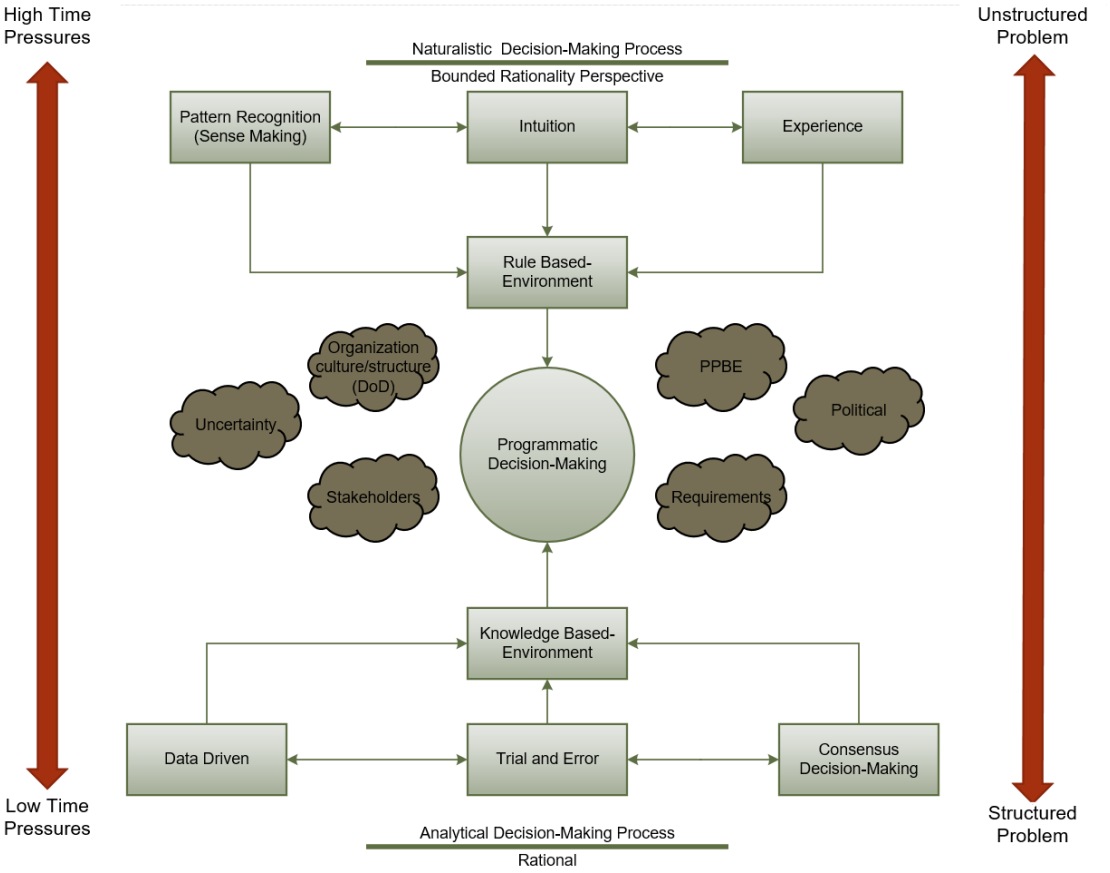


Figure 14. Program Manager Decision-Making Process

Finally, the evidence suggests that there is a clear distinction between the *art* and *science* of program management. The art of program management encompasses sensemaking, consensus-making, and trust. We have concluded that program managers spend most of their time trying to align stakeholders and gain consensus in order to influence key decision-makers at the highest levels of the DoD. Consensus-making is the responsibility of the program manager and is accomplished through constant engagement and calculated synchronization of important stakeholders. Gaining the consensus of decision-makers will not only keep the program alive but will provide the necessary level of credibility with the user, industry, and DoD decision-making authorities.

The science of program management is the precise application of both tacit and explicit knowledge. DOD acquisition professionals possess a unique set of skills and expertise that are necessary to successfully manage a product or program. Program

managers are the conduit of information between all stakeholders including industry, the user, and Congress. They should be relied upon to advise key decision-makers on the cost, schedule and performance of a program and trusted in their recommendation. From our research, this often is not the case and much organizational energy is wasted trying to educate the ignorant. Both Subjects A and B stated that the operational force wants to help but is often simply a nuisance.

## C. HYPOTHESES AND THEORIES

In this section, we introduce the two hypotheses and accompanying theories that shed light on how a program manager gains insight in the complex decision-making process. Analysis of the data provided evidence that suggests that environmental factors and stakeholder management are the two most influential aspects of a program manager's ability to shape positive programmatic results. Understanding how environmental factors and various stakeholders can affect program outcomes may help program managers more easily navigate through the complexity of ACAT 1, D programs. The following paragraphs introduce our hypotheses and theories.

### 1. Hypothesis 1

A program manager's ability to make decisions is fundamentally dependent on the acquisition environment.

### 2. Theory 1

Both Subject A and Subject B made it clear that their ability to make a decision was all based on the current acquisition environment they were working in. The environmental examples were budget, user requirements, operational culture, and reputation. Each program manager discussed these environmental elements and how they impacted their abilities to make decisions in an acquisition environment. It also seemed that the current environment in which a program manager makes decisions is complex to complicated, never chaotic. Compared to operational leaders, program managers rarely face problems that require a rapid decision-making response. Program managers operate within a more stable environment and are faced with complicated decisions because of the acquisition environment.

How the acquisition environment influences the program manager can be viewed as disruptive and occasionally, hindering the decision-making process. For example, Subject B discussed how the current operational culture is granting operational leaders more authority to influence system development. This new concept, according to Subject B, is disruptive due to lack of training and education when it comes to understanding the acquisition process. Subject B dedicated a significant amount of time educating these senior operational leaders because of their ability to influence timelines and system development. The Army's operational culture will continue to play a significant role in defining how the program manager will make decisions within the acquisition environment.

The program manager must understand these acquisition environmental factors in order to prevent disruption or hinder the decision-making process. We believe that environmental factors have more influence on the program manager's decision-making abilities than their human attributes. This is due to the Army's organizational structure and senior military leader control throughout a system's life-cycle development. Because of this, the program manager's capability for decision-making has become reactive and dependent on the environment to support his course of action development when faced with complex situations.

### 3. Hypothesis 2

Consensus making is the most important activity that a program manager undertakes to influence his program.

### 4. Theory 2

Consensus making is an activity, not a theory. In DOD acquisition, consensus making involves showcasing the capabilities and benefits of a program in order to educate, synchronize, and align key stakeholders to shape positive programmatic outcomes. Both Subject A and Subject B spoke at length about the importance of gaining consensus through active stakeholder management. Due to the linearity of the DOD acquisition decision-making chain of command, managing stakeholders from the lowest-ranking user to the highest-ranking member in the DOD is imperative to program survival and eventual

success. We have concluded that stakeholder management involves five critical steps: identification and categorization of stakeholders, educating stakeholders on program goals and showcasing technological capabilities and effectiveness, understanding stakeholder needs, synchronizing stakeholder actions, and managing steady-state stakeholder operations. Figure 15 highlights the steps of the DOD acquisition stakeholder management process.

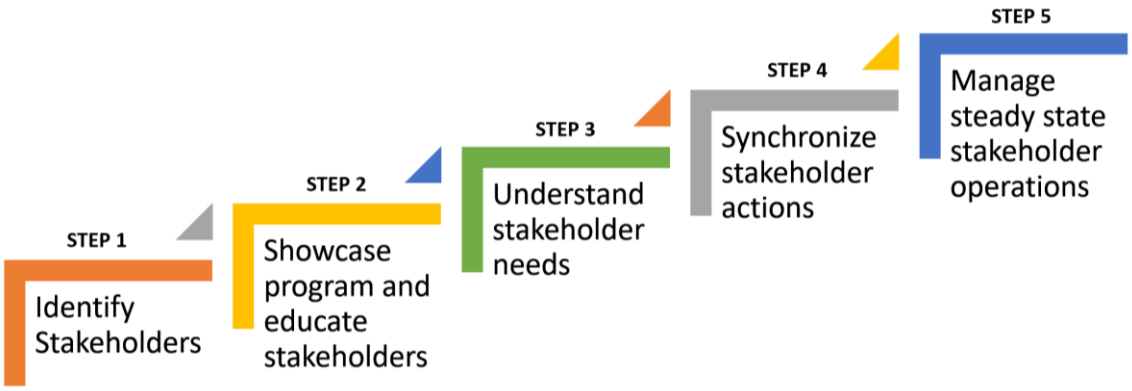


Figure 15. Acquisition Stakeholder Management Process

First, program managers must identify all stakeholders, assess stakeholder influence on program goals, and map stakeholders. After assessing each stakeholder, the program manager must categorize them from most important to least important. This can be done using a simple Excel spreadsheet and a color-coding scheme, such as green (important), amber (somewhat important), and red (not very important). Mapping stakeholders allows the program manager to continuously engage priority targets, and analyze, assess, and evaluate stakeholder influence on a program. Subject B spoke in depth about this process and how effective of a tool it was in the management of stakeholders and the accomplishment of the overall goal to gain consensus on his program.

Second, program managers must educate their stakeholders on the capabilities and effectiveness of their program. This must be put in terms of not only cost, schedule, and performance, but also into simple terms of how effectively the program addresses the capability gap on the battlefield. A large part of educating stakeholders on DOD acquisition programs is showcasing the technological capabilities of any given system and highlighting

its effectiveness in closing the capability gap on the battlefield. This is a two-pronged process facilitated by the prime contractor counterpart and can be conducted through distribution of press releases, data releases after key tests, and storyboards to the DoD chain of command. Highlighting a program in such a way maintains a constant state of relevance and keeps a program fresh in the minds of the user and DOD decision-makers.

Third, the program manager must understand the stakeholders' needs. This process is done virtually in sequence with educating the stakeholders on the program. This is a critically important step in the process, and without understanding stakeholder needs, the program manager will not be able to synchronize stakeholder efforts. This step requires a level of maturity and empathy on behalf of all leaders and will open a dialogue that will inevitably lead to tradeoffs and compromise.

Fourth, program managers must synchronize stakeholder actions. This is the most difficult task the program manager will undertake in stakeholder management, but also the most beneficial if the program manager succeeds. Although the program manager will not be able to fulfill every stakeholder need, it is vitally important to entertain the most important objectives of each internal and external organization that has a profound impact on the program. Synchronizing the effort of multiple stakeholders first requires synchronizing the goals of all stakeholders to align with the projected outcomes of the program. Like a quarterback leading his team in a two-minute drill, the program manager must command all facets of the program from finances, to contracting, to test and evaluation, to manufacturing, and to production.

Lastly, the program manager must continuously monitor and keep a pulse on steady-state stakeholder operations to ensure synergy through program completion. The stakeholder matrix mentioned in step 1 of Figure 15 is a living and breathing document that requires constant attention and updating. It is a document that will help facilitate the management of steady-state stakeholder operations and will tell the program manager where he must apply attention. Managing stakeholder steady-state operations requires constant engagement, outreach and showcasing. It is the responsibility of the program manager to champion the program from the day charter is assumed.

## D. CHAPTER SUMMARY

This chapter provided analysis on the data gathered during the interview process. It highlighted the importance of sensemaking to understand the acquisition environment, how program managers use data to gain consensus and influence the decision-making process, and how tacit knowledge and technical expertise can develop a sense of trust and confidence that is necessary for program success. The chapter also introduced two hypotheses: first, that a program manager's ability to make decisions is dependent on the environment, and second, that consensus-making and stakeholder management are the two most important actions a program manager can take to influence his program. In the following chapter, we conclude this paper and provide a summary of our research and our recommendation.

# V. CONCLUSION

## A. SUMMARY OF RESEARCH

The purpose of this research was to identify how Army program managers make decisions within the current acquisition environment. From our analysis, we were able to identify five aggregate categories that influence a program manager's decision-making process. These categories were further grouped into what we classify as the "art, skill, and science" of decision-making when faced with complex problems. Our hypotheses suggest that both environmental factors and stakeholder management are critical aspects that shape how program managers make decisions. Furthermore, understanding these principles and theories can help guide future program managers as they navigate through complex program environments.

## B. RECOMMENDATION

Based on our research and the limited amount of information provided on the subject, we recommend that further research be conducted on how a program manager gains insight into the decision-making process. Continued research will refine the current understanding of how DoD acquisition professionals make decisions and could help us better shape future outcomes. This could result in cost and schedule savings while providing the warfighter with the very best capabilities on the ground. Future fights will be won or lost by men and women who are brave enough to sacrifice it all for the potential of a brighter future. We are lucky to have such brave souls with a perspective larger than just themselves. They deserve the very best. A program manager's job is to deliver the very best. That is why this research matters. After all, it may save a life someday.

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