NPS-IT-12-176

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Analyzing the U.S. Marine Corps Enterprise Information Technology Framework for IT Acquisition and Portfolio Governance

5 September 2012

by

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ABSTRACT

This research examined the ongoing development of a Marine Corps–wide, enterprise architecture (EA) approach for assessing the IT planning and investment process, including IT-related programs of record. The enterprise architecture approach to architecture, known as the Marine Corps Information Enterprise Technology Strategy (MCIENT-S), is intended to transition the Marine Corps into the 21st century by providing Marine Corps leadership with superior decision support. This study evaluated planning and implementation strategies against return on investment (ROI) and requirements-based Capabilities Based Assessment (CBA) processes in their contrasting measures of effectiveness. By analyzing the current and proposed additional IT investment performance metrics to enhance the enterprise architecture, the study learned of the need to conduct an organizational analysis of the Marine Corps IT development and portfolio management process.

The study begins with a baseline understanding of the current financial environment of enterprise architecture from the initial and rapid growth in defense-specific IT acquisitions since 9/11 into the current fiscally constrained environment of fiscal year (FY) 2013. The rising trend of the last decade of defense (IT) investment yields its own unintended consequences. One noted conclusion is that some procurements have unfortunately occurred outside the intended parameters of the enterprise architecture framework and the DoD acquisition process, thereby creating consequences in IT governance. One recommendation for the Marine Corps leadership is to develop a systematic process to link the MCIENT-S and its two primary ROI processes, Capital Planning Investment Control (CPIC) and Information Technology Steering Group (ITSG), to the Marine Corps Combat Development Command (MCCDC) requirements-based CBA process.

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ACKNOWLEDGMENTS

The authors greatly appreciate their advisors, Glenn Cook and Dr. Cary Simon, as well as the copyediting staff at the Acquisition Research Program (ARP). We appreciate their guidance, insight, and support throughout the development of this thesis. A special thanks to all of the NPS professors and faculty throughout our dual master's programs who provided outstanding suggestions and recommendations, which gave our thesis greater depth. From the sponsors at ARP, we would like to thank Ms. Tera Yoder and Ms. Karey Shaffer.

Tim: I would like to first and foremost thank God, for giving me the strength to stay focused and on task to be able to complete this challenging dual master's degree program. I would also like to thank my wonderful family and especially my loving wife, Fanny, who supported me despite the demanding requirements in pursuing a double master's these past two years at NPS. Finally, I dedicate this work to Rudy, my super dog, who stood by my side while I had to stay up late through many nights studying through high school, college, flight school, and finally at NPS.

Laban: I want to thank my wonderful wife, Jodi, for her support these past two years, as I spent many nights and weekends at the library studying for classes and writing this thesis. My pursuit of a dual degree would not have been possible if not for her encouragement and her being an amazing mother to our son. I also want to thank my parents for instilling in me the drive to learn, and for their continued encouragement throughout my career.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACAT	Acquisition Category
AFEI	Association for Enterprise Information
ATAM	Architecture Tradeoff Analysis Method
BCA	Business Case Analysis
BMA	Business Mission Area
C4	Command, Control, Communication, and Computers
CBA	Capabilities-Based Assessment
CCA	Clinger-Cohen Act
CEA	Cost-Effective Analysis
CEO	Chief Executive Officer
CIO	Chief Information Officer
CMC	Commandant of the Marine Corps
COCOM	Combatant Commander
COTS	Commercial-off-the-Shelf
CPIC	Capital Planning and Investment Control
DAS	Defense Acquisition System
DC CD&I	Deputy Commandant, Combat Development and Integration
DC P&R	Deputy Commandant, Programs and Resources
DIMA	Defense Intelligence Mission Area
DIRINT	Director of Intelligence (Marine Corps)
DoD	Department of Defense
DoDAF	*Department of Defense Architecture Framework*
DoN	Department of the Navy
EA	Enterprise Architecture
EFDS	Expeditionary Force Development System
EIEMA	Enterprise Information Environment Mission Area
EVM	Earned Value Management
FAM	Functional Area Manager
FFA	Five Forces Analysis
FMF	Fleet Marine Force
FSRG	Force Structure Review Group
GAO	Government Accountability Office
HQMC	Headquarters Marine Corps
HQMC-I	Headquarters Marine Corps Intelligence Department
IM	Information Management
IPT	Integrated Product Team
ISR	Intelligence, Surveillance, and Reconnaissance
IT	Information Technology
ITSG	Information Technology Steering Group
JCIDS	Joint Capabilities Integration and Development System
MARFORs	Marine Forces

MCCDC	Marine Corps Combat Development Command
MCEN	Marine Corps Enterprise Network
MCIE	Marine Corps Information Environment
MCIENT-S	Marine Corps Information Enterprise Strategy
MCISRE	Marine Corps Intelligence, Surveillance, and Reconnaissance Enterprise
MCITE	Marine Corps Information Technology Environment
MCSC	Marine Corps Systems Command
MCSCP	Marine Corps' Service Campaign Plan
MROC	Marine Requirements Oversight Council
NCW	Net-Centric Warfare
NPS	Naval Postgraduate School
NSS	National Security Systems
PA&E	Program Assessment and Evaluation
PKE	Public Key Enablement
PPBE	Planning, Programming, Budgeting, and Execution
QDMP	Quantifying Decision-Makers' Preferences
R&D	Research and Development
ROI	Return on Investment
SA	Stakeholders Analysis
SM	Strategic Management
TOA	Total Obligation Authority
UAV	Unmanned Aerial Vehicle
VIRT	Valuable Information at the Right Time
WMA	Warfighting Mission Area

I. INTRODUCTION

During the rapid mobilization after the attacks on September 11, 2001, the U.S. military saw substantial growth in procurement and technology investment spending. Although the Marine Corps has traditionally occupied a less influential position among all of the interests vying for the Department of the Navy's (DoN) resources, according to Conetta (2010), supplemental funding has expanded for all four Services in the past decade to the point where the rate of research and development (R&D) and procurement spending has exceeded the Department of Defense (DoD) modernization spending during the Reagan administration (Conetta, 2010, p. 6). Rare in its history, the Marine Corps was given enough funding to meet all of its operational requirements, presenting both a blessing and a curse.

After supplemental funding spread across 10 fiscal years, the Marine Corps is now in a position where it must sort through a maze of so-called "boutique" information technology (IT) systems. Many of these IT systems were procured during this recent era of hyper-spending to meet local commanders' requirements and did not take into account long-term effects. Furthermore, investment, procurement, and life-cycle maintenance spending is expected to be reduced in the near future. Therefore, as the DoD transitions into an era of constricted budgets, it is all the more imperative that the Marine Corps develops a disciplined and comprehensive enterprise approach for reviewing its IT investments. The approach is intended to reduce waste and redundancy without adversely affecting readiness.

A. THE NEW ERA OF IT PROCUREMENT

Although investment spending for the Marine Corps comprises a small percentage of the total obligation authority (TOA), it is discretionary in nature and is often used to offset other budgetary shortfalls. The researchers' premise is that to remain a superior 21st-century fighting force, the Marine Corps needs to invest in the right information technology. However, current and future budget climates may hinder the Marine Corps, as well as the entire DoD, in terms of overall force readiness (Keller, 2010).

In fact, with federal mandatory spending on the rise, to include national healthcare, some items that were traditionally thought of as untouchable—such as military retirement pensions—may see their funding reduced alongside traditionally cut military budget items, such as investment spending (Springer, 2010). Although some planners and economists are focused on military personnel entitlement spending items, studying how the rise in entitlement costs might be addressed, this rise in mandatory spending does pose a constraint on the overall budget (Hensel & Deichert, 2008). Military planners are more concerned about the strategic impact that the fiscal cuts will have on military operational readiness, particularly how it stalls procurements. Former Defense Secretary Robert Gates stated the following:

> The continuing resolution under which the Defense Department is operating does not allow it to purchase new equipment or make other purchases. It keeps spending levels at the same amount as 2010 as well. About 50 military projects are on hold, and defense contractors are increasingly nervous about Congressional foot-dragging about the budget. I raise this point today because I am concerned that the debate over the defense budget in recent days and weeks is becoming increasingly distant from strategic and operational reality—distant, in other words, from the real world. (Gillentine, 2011)

Secretary Gates evidently did not intend to sit idly by while Congress strips funding, which threatens military readiness. Rather, he appeared committed "to changing the way that DOD does business [and thereby] . . . reallocating existing DOD funding to priority weapon programs in advance of budget rollbacks by the U.S. government" (Bruno, McLeary, & Mecham, 2010, p. 20).

With large or highly advanced weapons and information systems requiring significant sums of money in operating and maintenance (Keller, 2008), it is highly unlikely that the funds for procurement will continue to be available for the Marine Corps to be able to maintain technological superiority on the battlefield. A major obstacle emerging in this technological age of warfare is transitioning static or legacy information systems of the 20th century into the dynamic systems that will be required to win complex battles of the 21st century.

In order to prepare for success in the 21st century, the Marine Corps in 2008 published *Marine Corps Vision & Strategy 2025* (Conway, 2008). This document

outlined the hierarchy and relationships of the Marine Corps' current and future resource allocations (see Figure 1).
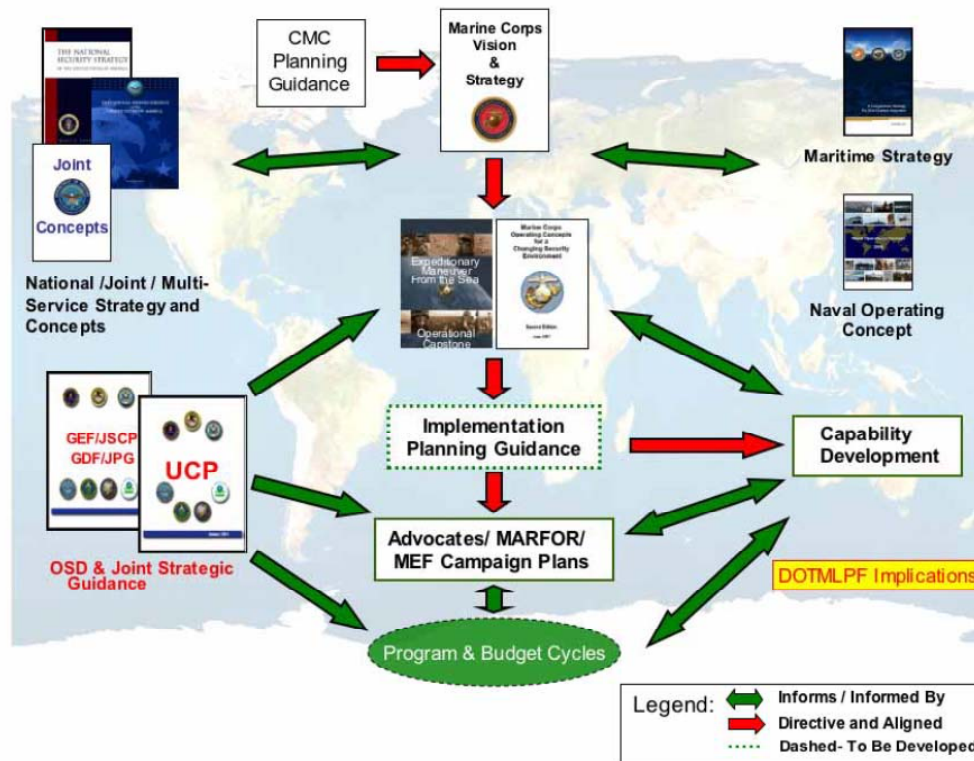
Figure 1.   Marine Corps Vision and Strategy's Hierarchy and Connectivity
(Conway, 2008, p. 4)

Based on the principles set forth in the *2008 National Defense Strategy* (Department of Defense [DoD], 2008), the *Marine Corps Vision & Strategy 2025* (Conway, 2008) seeks to transition the Marine Corps to a smaller, more agile fighting force. Based on the principles of net-centric warfare (NCW), the capabilities of this fighting force are inherently dependent on technological advancements. In Albers, Garska, and Stein's (2000) *Network Centric Warfare*, it is apparent that in the past decade the "dramatic increases in global information access, breakthroughs in the biological and material sciences, and [our] increasing reliance on cyber-technology will enable the diffusion of destructive power to smaller and smaller groups" (Albers, Garska, & Stein, 2000). Thereby, through the NCW principles, the Marine Corps will "continue to exploit technology to enhance the performance of the individual warrior" (Conway, 2008, pp. 13–14). The Director of Command, Control, Communication, and Computers (C4) saw

the need to begin planning to fight in this new type of warfare. This vision led to the development of the Marine Corps Information Enterprise Strategy (MCIENT-S).

B. MCIENT-S: THE VISION AND THE CHALLENGE OF MEETING THE DEFENSE ARCHITECTURE

In the past decade, the DoD chief information officer (CIO) published the *Department of Defense Architectural Framework* (*DoDAF*) in order to implement standards across the DoD spectrum. The objectives of the *DoDAF* are summarized as follows: "(1) Create IT systems and architectures that cross organizational and national boundaries and (2) provide a common denominator of understanding, comparing and integrating these Families of Systems (FoSs), System of Systems (SoSs) and interoperating and interacting architectures" (DoD CIO, 2004, p. 1-1). The *DoDAF* stresses a core architectural data model across three major perspectives: operational, systems and services, and technical. The Director of Headquarters Marine Corps, C4, received guidance from the DoD CIO via the DoN CIO to meet the requirements of the *DoDAF*. From this direction, the MCIENT-S was born to provide a framework for meeting the *DoDAF's* two objectives (see Figure 2).
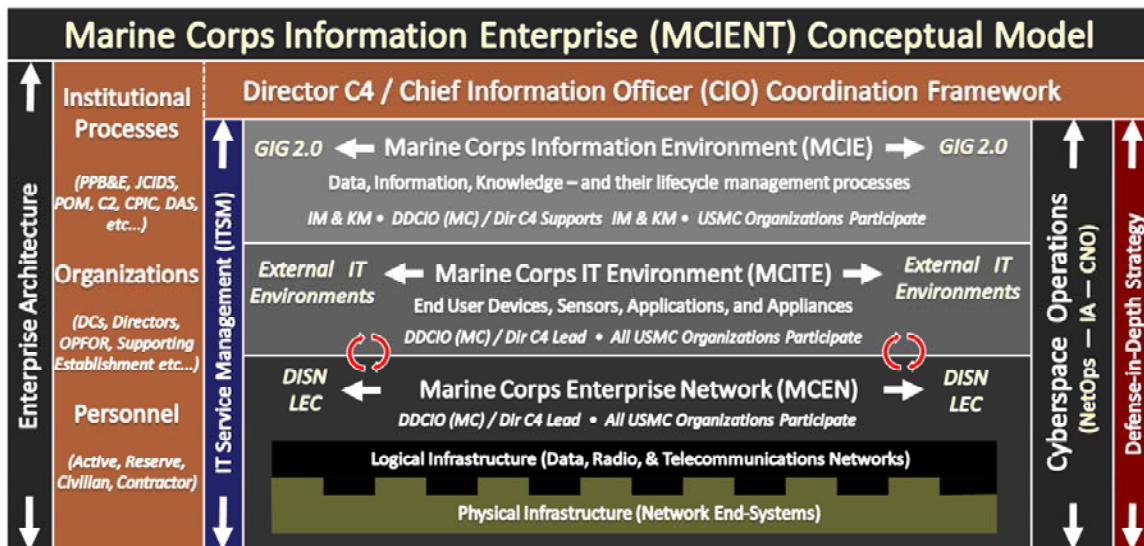
Figure 2.   Marine Corps Information Enterprise Strategy
(Nally, 2010, p. 10)

To accomplish an integrated IT framework is no small feat, as the current situation is essentially a puzzle that does not lend itself to easy assembly. However, it is essential that the Marine Corps addresses such issues in its infrastructure to meet such challenges. In a July 2010 report, the Government Accountability Office (GAO) made the following recommendation: "[the] GAO recommends the [Army and Marine Corps] develop a risk-assessment and mitigation plan to address gaps in . . . [their] capacity, and assess how [they] can maximize existing resources to . . . [their] force generation model. DOD generally agreed with our recommendations" (p. 2).

In a separate report in 2006, the GAO examined the several key capital IT investments on which the DoD currently spends vast sums of money. One of the findings was of the inefficiencies in the entire IT systems acquisition process, from project management all the way to the end of a system's life cycle. One of the case studies that the GAO noted was the case of unmanned aerial vehicles (UAV), described as follows:

> Despite their success on the battlefield, DOD's unmanned aircraft programs have experienced cost and schedule overruns and performance shortfalls. . . . Until DOD develops the knowledge needed to prepare solid and feasible business cases to support the acquisition of J-UCAS and other advanced unmanned aircraft systems, it will continue to risk cost and schedule overruns and delaying fielding capabilities to the war fighter. (GAO, 2006, pp. 1–2).

A major shortfall in DoD systems such as the UAV is the current lack of efficiency in the design process. One of the methodologies with which then-Commandant Conway intended to combat this inefficiency was the implementation of earned value management (EVM) procedures in managing the acquisitions and systems. C4 has noted major improvements since utilizing EVM: "By using an earned value management (EVM) system to define project goals, C4 saved $500,000 over two years while significantly increasing the quality of their products and their efficiency" (D'Auria, 2009, p. 24).

Another challenge to meeting this requirement is the lack of business enterprise architecture across the DoD spectrum. This was apparent in a 2005 GAO report on the DoD's IT architecture, which stated the following:

Having and using well-defined enterprise architecture are essential for DOD to effectively and efficiently modernize its nonintegrated and duplicative business operations and systems environment. However, the department does not have such architecture, and the architecture products that it has produced to date do not provide sufficient content and utility to effectively guide and constrain the department's ongoing and planned business systems investments. (GAO, 2005, p. 44)

The challenge of developing a DoD-wide IT enterprise architecture is made more difficult by the trend of developing a physical schema of static IT systems that are unable to fulfill the requirements of transitioning into the dynamic systems required to fight tomorrow's battles.

Furthermore, as Professor Kishore Sengupta (personal communication, January–March 2012) notes, many of these systems are fashioned into what are termed "Silos of Information" design and "Islands of Inefficiencies" design, as opposed to the desired "Integrated Network" design. Regardless of the tendency to use the same approach when addressing this dilemma of stove-piped systems, the challenge of a non-integrated network must be met from a systems design and organizational approach. The need is to approach the NCW concept as a cultural change that allows the DoD to move from the line-in-the-sand warfare of the 20th century to the NCW of the 21st century (Horn, Cofield, & Steele, 2007).

C.   THE PLAN: "HOW DO WE GET TO THE FUTURE?"

As the physical battlefield of the 20th century blurs into the cyber domain, one of the DoD's major transitions is to meet on the battlefield of cyberspace with a cyber-command. Also, as the power of computing becomes more and more centralized in servers rather than personal machines, the Marine Corps is seeking to advance into the future via the realm of virtualization (Thibodeau, 2007). However, the current IT infrastructure will not allow this to happen due to long-standing weaknesses in the DoD's enterprise architecture that it failed to address in prior years (GAO, 2005). This deficiency has placed stress particularly on the largest branch, the U.S. Army, which has the most investment stake at risk from its lack of integrated business strategy causing cost overruns (Rhodes & Solis, 2007). Because this is not an Army-specific threat, the DoD has provided guidance to implement an interdepartmental business systems

modernization approach but has left out critical details—that is, an integrated strategy—to execute such changes. Without this strategy, "the department will remain challenged in its ability to minimize duplication and maximize interoperability among its thousands of business systems" (GAO, 2007).

Unlike the U.S. Army, the U.S. Marine Corps has a culture of innovation and out-of-the-box thinking (Terriff, 2006, p. 475). Studies such as those carried out by the Force Structure Review Group (FSRG) plan for the "make-up of the post-Afghanistan structure of the U.S. Marine Corps" (Work, 2010, p. 8), which likely will be composed of major budget shortfalls with as many as, or more than, the current operational requirements placed on the organization. According to General James Amos, the 35th Commandant of the Marine Corps, the purpose of the FSRG is to assist the "rebalance [of] our Corps, posture it for the future and aggressively experiment with and implement new capabilities and organizations" (Amos, 2010a, p. 8).

Therefore, MCIENT-S is essentially the Marine Corps' response to the current financial crisis, as well as to the DoN CIO's guidance for "transformation in delivering [IT] value" to (1) create IT agility, (2) reduce complexity, (3) lower operational costs, and (4) enhance portfolio management (Ecarma, 2009).

In the MCIENT-S, C4 divides life-cycle management in the IT roadmap for the Marine Corps into four phases: development, communication, execution, and assessment (see Figure 3). This methodology consists of leveraging current and future requirements against current and future resources. The process ensures that

> MCIENT Strategy and future updates are: (1) developed in support of Marine Corps institutional objectives, (2) communicated across the Corps and to external audiences, (3) executed by the organization, and (4) are assessed and reviewed for relevance and for implementation success. (Nally, 2010, p. 7)
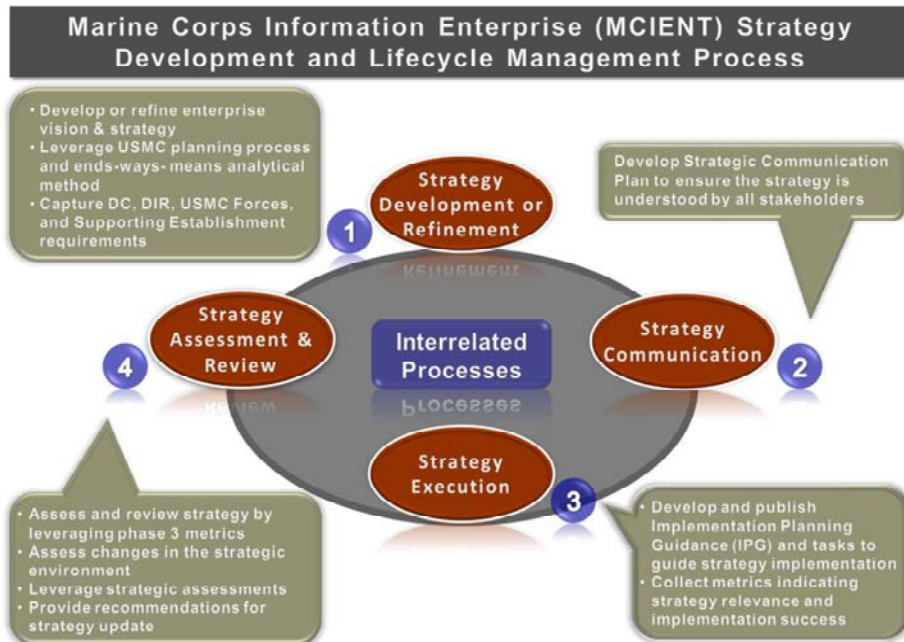
Figure 3.   MCIENT's IT Life-Cycle Management Process
(Nally, 2010, p. 8)

Currently, the MCIENT-S conceptual model proposes to implement the four-phase strategy into a timeline from now until 2015. The MCIENT-S will shift stakeholders from the current quagmire into distinct, supportive categories, and it will also distinguish IT governance requirements from IT management issues, thereby ensuring that both fields are sufficiently addressed. Finally, MCIENT-S will implement changes to the Marine Corps' systems acquisition process to accommodate exponential changes in technology in an era of budget deficits and funding shortfalls.

Enterprise architecture (EA) has been a prevailing theme for the DoD in the last decade and has generated a lot of research. When coupled with the Marine Corps' need for an institutional approach for its IT strategy, the driving force of this research is to incorporate this concept and thereby assist C4 and its sister organizations under the framework of Headquarters Marine Corps (introduced and discussed in the next chapter) to meet the goals of the MCIENT-S in order to best achieve the vision set forth in *Marine Corps Vision & Strategy 2025* (Conway, 2008).

The purpose of this research is to assist in laying the groundwork for the development of a Marine Corps–wide, comprehensive enterprise approach for assessing

the process of IT planning and investments, and of IT-related programs of record. The current architecture represents an ongoing transition into a framework that may well provide superior decision support for Marines. As the current enterprise architecture continues this transition per the Marine Corps' five-year roadmap, it is vital that planning and implementation are evaluated against measures of effectiveness. A significant portion of this study is directed at addressing current and proposing future IT investment performance metrics in light of the enterprise architecture.

The focus of the financial aspect of enterprise architecture is critical; over the last decade there has been significant growth in defense-specific IT acquisitions. Unfortunately, due to the rapid pace of investment, much of this procurement was made without much respect to the enterprise architecture framework. In addition, such spending is projected to decline for the next several years as the DoD transitions into an era of budget constrictions. Therefore, it is imperative that the Marine Corps, as an entity of the DoD, develops a disciplined institutional framework for reviewing current IT investments to ensure the most effective cost-benefit procedures.

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II. DOD ACQUISITION AND IT PORTFOLIO MANAGEMENT

A. THE DOD DECISION SUPPORT SYSTEM

To set the tone for a discussion of IT portfolio management, it is important to begin with the Defense Acquisition System. As discussed in the four sections of the first chapter of the *Defense Acquisition Guidebook* (DoD, 2012), this integrated DoD Decision Support System Framework is composed of three decision support systems. These three systems are constantly operating, and when they interact, they provide the means (potentially) for decision-makers to determine how to spend turbulent/uncertain research, development, and acquisition funding. The Decision Support System is summarized in the following sections.

1. The Planning, Programming, Budgeting, and Execution Process

The Planning, Programming, Budgeting, and Execution (PPBE) process is the DoD's primary resource allocation process. PPBE is an annual, calendar-driven process used to secure funding for all military programs—to include acquisition projects. PPBE provides the basis for decision support by assessing affordability against proposed resource allocation programs.

2. Joint Capabilities Integration and Development System

The Joint Capabilities Integration and Development System (JCIDS) is a requirements-driven process, typically determined by deficiencies or needs of the warfighter. The JCIDS determines mission requirements by implementing strategies to meet those requirements. Thereby, the JCIDS provides the basis for establishing priorities.

3. Defense Acquisition System

The Defense Acquisition System (DAS) establishes a management process to translate user needs and technological opportunities into reliable and sustainable systems that provide capability to the user. It involves the process of periodic review and approval of programs to progress into subsequent phases of the acquisition life cycle, and

it provides a streamlined management structure that links milestone decisions to demonstrated accomplishments. For a complete depiction of the integration of the DoD support system and a graphical depiction of each of the three elements, each of these systems will now be described, as well as the Marine Corps entity that is responsible for each system's functioning. The integration of the three systems is depicted in Figure 4.
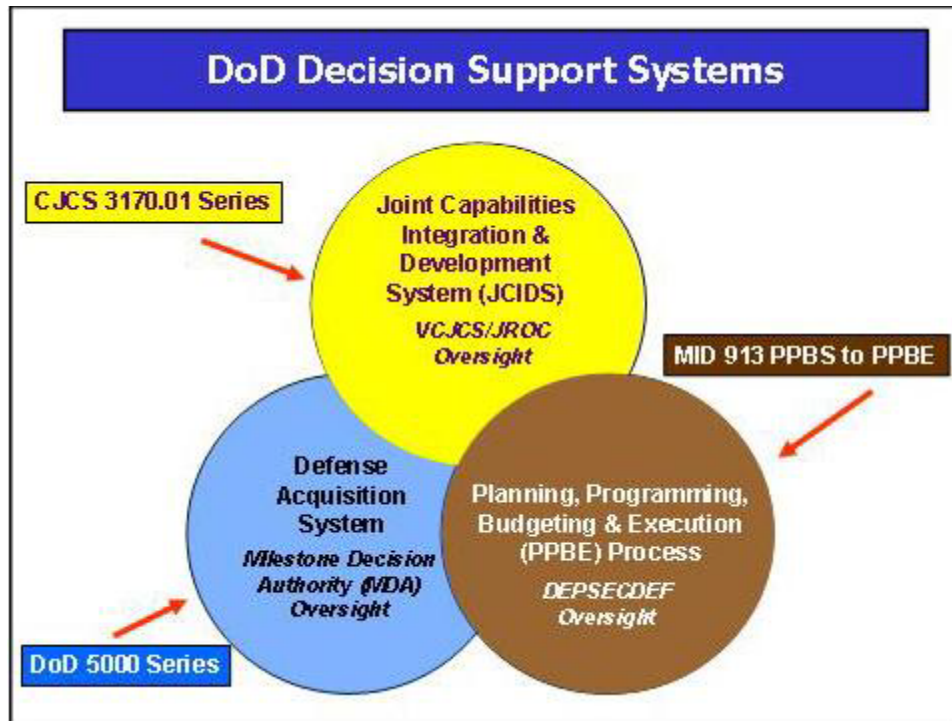
Figure 4.   The Relationships Between the Three DoD Decision Support Systems
(DoD, 2012, Chapter 1-1)

B.   THE MARINE CORPS IT ACQUISITION DECISION SUPPORT SYSTEM

As Henry Mintzberg (1981) noted, organizational design can strongly influence or shape organizational structure, processes, culture, and results or performance. The PPBE system formalizes the responsibility, authority, and other decisions in all major DoD acquisition projects, including IT and IT portfolio management.

The history of PPBE goes back to the 1960s during the tenure of Defense Secretary Robert McNamara, who sought to manage requirements across the DoD through a single resource allocation system. Unfortunately, Mr. McNamara's attempt to win the Vietnam war using whiz-kid calculations of Vietcong body-counts was a tragic

disaster. The DoD has been using PPBE (though the name has evolved) since then; however, in the case of IT acquisition, there are numerous regulations due to the Information Technology Management Reform Act of 1996, better known as the Clinger-Cohen Act (CCA, 1996).

Among the requirements that the CCA specifies in the case of IT, is the need for each agency in the executive branch of government to establish a CIO, whose primary responsibility is "developing, maintaining, and facilitating the implementation of a sound and integrated information technology architecture" (National Partnership for Reinventing Government, 2001). Because the DoD systems primarily fall under the National Security Systems (NSS), the CCA exempts those systems from most of the provisions of the Act except the requirements to conduct capital planning and investment control (CPIC), performance- and results-based management, CIO responsibilities, and finally, overall accountability.

The PPBE system and CCA responsibilities intertwine in the roles of IT acquisition and portfolio management. This has forced all of the DoD agencies to design processes to ensure compliance to both effective and efficient management of resources. The story of the Marine Corps' IT procurement and portfolio management is the story of an organization attempting to meet the requirements of dueling guidelines and constrictions. In the heart of both of these processes is the Director, C4. For this reason, in December 2010, Director, C4 published the *MCIENT-S* (Nally, 2010; see Chapter II for thorough discussion) in order to integrate and streamline all of the requirements of IT management.

C. CURRENT ORGANIZATION OF THE MARINE CORPS' IT ACQUISITION AND PORTFOLIO MANAGEMENT PROCESSES

There are three primary organizations in the Marine Corps that have been assigned responsibilities for IT Acquisition and Portfolio Management. They are as follows:

1. Headquarters Marine Corps (HQMC): Director, C4 and DC, P&R

The Director, C4 "plans, directs, and coordinates all staff activities relating to C4 functions, and supports the Commandant of the Marine Corps (CMC) in his role as a member of the Joint Chiefs of Staff ("Headquarters Marine Corps Command," 2012). In essence, C4 is responsible for setting the IT strategic direction, goals, and objectives for IT. C4 provides high-level IT direction and priorities for all Marine Corps entities with IT responsibilities, whether they manage existing capabilities or procure future capabilities. In essence, the Director, C4 serves a similar function to the CMC in supporting and advising that a staff communication officer would to a commanding general. According to the C4 mission statement, the Director's role is as follows: "As the [CIO] of the Marine Corps, [the Director, C4] provides oversight of Marine Corps [IT] infrastructure, governance and policy of Marine Corps IT, and represents the Marine Corps at Federal [DoD], Joint, and [DoN] IT forums" ("Headquarters Marine Corps Command," 2012).

Under the CIO capacity, the Director, C4 maintains all CCA responsibility to the DoN CIO. Furthermore, in the PPBE process, C4 coordinates with the Deputy Commandant for Programs and Resources (DC P&R) by providing CCA recommendations for all IT acquisition projects and IT programs of record. In the PPBE process, the DC P&R "serves as the principal advisor to the CMC on all financial matters and serves as CMC's principal spokesperson on USMC program and budget matters" (U.S. Marine Corps, 2012). Figure 5 is a graphical depiction of how the PPBE process relates to the Decision Support System.
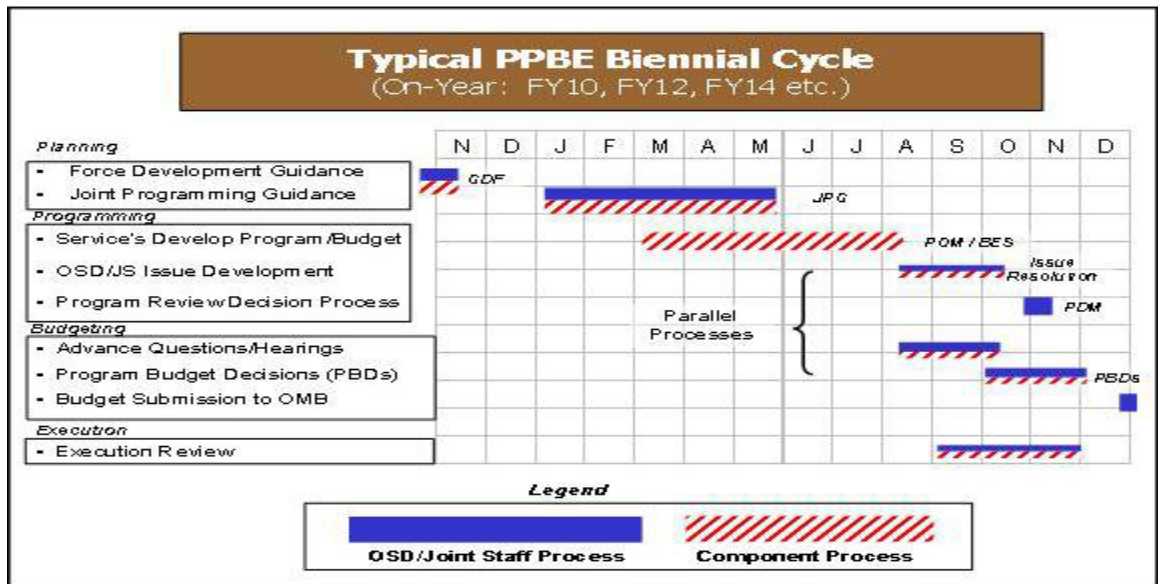
Figure 5.   PPBE On-Year Cycle
(DoD, 2012, Chapter 1-1)

2.   Marine Corps Combat Development Command

The commanding general of MCCDC is also known as the Deputy Commandant, Combat Development and Integration (DC CD&I). The DC CD&I's mission is to "develop fully integrated Marine Corps warfighting capabilities; including doctrine, organization, training and education, materiel, leadership, personnel, and facilities, to enable the Marine Corps to field combat-ready forces" ("Marine Corps Combat," 2012). In essence, CDI serves the JCIDS function of integrating capabilities across the Marine Corps commands into the Marine Corps-specific version of the JCIDS called the Expeditionary Force Development Systems (EFDS). Also, the DC CD&I chairs the Marine Requirements Oversight Council (MROC) Review Board, which provides the initial review and recommendations to the MROC in assessing all capabilities and deficiencies against the warfighter requirements. Figure 6 is a graphic depiction of how the JCIDS relates to the acquisition process.
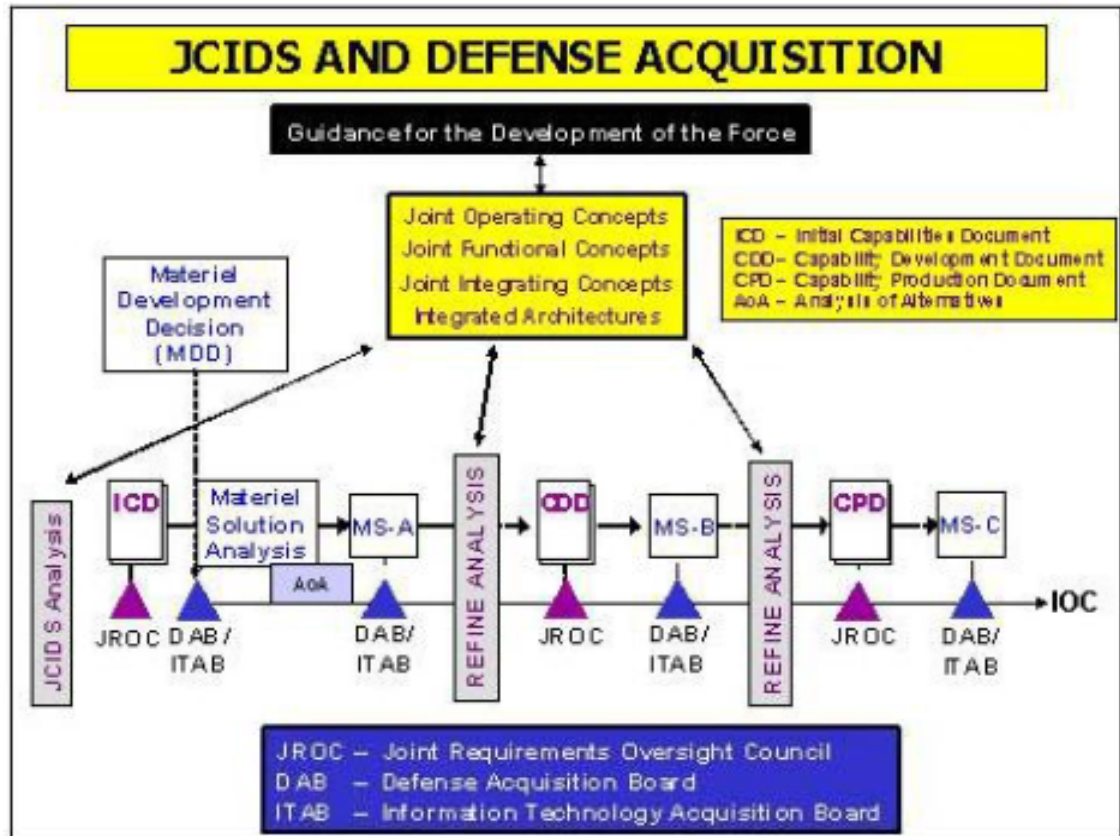
Figure 6.   JCIDS Process
(DoD, 2012, Chapter 1-1)

3.   Marine Corps Systems Command

The commander, MCSC serves "as the Commandant's agent for acquisition and sustainment of systems and equipment used to accomplish the Marine Corps' warfighting mission" ("Marine Corps Systems Command," 2012). As the CMC's executive agent for acquisition, MCSC essentially fulfills all functions related to the DAS by providing all of the Marine Corps' acquisition needs.

Through these three major commands, the Marine Corps seeks to assess, provide, and manage IT capabilities by blending the PPBE process along with CCA requirements under the direction of the CMC and the DoN CIO. In later chapters, the discussion transitions into the methods by which these commands accomplish these methods; this research thereby necessitates a critique in order to provide grounded recommendations related to their current processes.

D. MARINE CORPS INFORMATION ENTERPRISE

Before one can analyze the problem regarding IT governance laid out in the previous chapter, he or she must first define the IT enterprise architecture required against what is currently available. In the *Marine Corps Enterprise Network (MCEN) Concept of Employment* (Nally, 2011a), the Director, C4 seeks to define the Marine Corps enterprise architecture's future state—MCEN. The vision is for the MCEN to be a dynamic system. It is designed to serve Marines in their missions by "providing the successful transmission and reception of critical information vital to the commander's decision making process" (Nally, 2011a, p. 2-6). The *MCEN Concept of Employment* (Nally, 2011a) gives the best definition available of the Marine Corps Information Enterprise (MCIENT) by discussing it through the lens of its relationship with the information environment and network. The MCEN defines the MCIENT as follows:

> The MCEN assures the transfer of data between systems to ensure that timely and accurate information can be presented to commanders and those who work for them in support of information-driven decision making processes. . . . The MCEN is aligned to the Marine Corps Information Enterprise (MCIENT) as described in the MCIENT-S, supporting the MCIENT and its subordinate environments. The MCEN enables the Marine Corps Information Technology Environment (MCITE) and the flow of data, information, and knowledge across the Marine Corps Information Environment (MCIE), in order to ensure that decision makers and systems can receive timely and accurate information. The MCEN, MCITE, and MCIE together comprise the MCIENT. (Nally, 2011a, p. 1-4)

In *Network Centric Warfare*, Albers et al. (2000) conducted research into the potential power of the internet age, under the direction of the Assistant Secretary of Defense. Albers envisioned how the internet would enhance military combat capability through the concept of NCW by rapidly moving information across the battle space in what is termed information superiority. The tenets of NCW were immediately adopted by the Joint Chiefs of Staff, who, in turn, embraced NCW across the board because they concurred with the authors that "this high level of awareness has been key to both developing strategy and improving effectiveness at the operational level" (Albers et al., 2000). Therefore, the MCEN is a current manifestation of the Marine Corps' vision of NCW.

Beyond the tactical scope of the MCEN is the role that the MCIENT plays in the function of IT portfolio management. Per the CCA, the term *information technology architecture*, with respect to an executive agency, means "an integrated framework for evolving or maintaining existing information technology and acquiring new information technology to achieve the agency's strategic goals and information resources management goals" (National Partnership for Reinventing Government, 2001). The implication of this definition is that the only way to effectively and efficiently move forward in an era of constricted budgets is to have robust technology architecture.

This is because enterprise architecture is merely the business framework plus the components, which means that components are the parts that make up a system. The business framework is the organization and structure of these components. Architecture is the overall picture of components and how they interact with each other. The architecture essentially answers the following three very basic, yet important, questions:

1) "How are the system components organized?" *Answer: Architecture defines how the system components are structured and how they interact.*

2) "What is the solution for the budget crisis?" *Answer: Architecture gets the cheapest and best components together.*

3) "How do the system components communicate with each other?" *Answer: Architecture defines how the system components interact with each other, as seen in the MCEN.* As stated in Figure 7, "If it's part of the Marine Corps, it's part of the Enterprise Architecture" (Nally, 2011a).

Figure 7. Marine Corps Enterprise Architecture
(Nally, 2011a, p. 3-9)

With the DoD facing major budget restrictions and program cuts, it is the responsibility of all the parties involved to try to improve the odds of expensive system procurements being successful. According to the DoD CIO, this is only possible through establishing an effective enterprise architecture (Takai, personal communication, August 23, 2012).

An issue that is unique to IT acquisition programs is Moore's law. In his 1965 article, Intel co-founder Gordon E. Moore described a trend that computing power is doubled in a year-and-a-half cycle (Moore, 1965). Currently, the procurement process for long-term IT acquisition is costly and inefficient. This is because, according to Moore's Law, technology advances and changes every 18 months, while the acquisition cycle for a major program is typically greater than five years. This means that by the time these expensive long-term systems are fielded, they are already outdated. Therefore, the only way to truly fix the IT acquisition problem is to find a way to reduce the acquisition cycle to no more than two years; this will prevent the DoD and Marine Corps IT systems from lagging far behind technological growth.

E. ACQUISITION REVIEWS AND RETURN ON INVESTMENT

In the Software Engineering Institute report *ATAM: Method for Architecture Evaluation* (Kazman, Klein, & Clements, 2000), the authors described how the Architecture Tradeoff Analysis Method (ATAM) and other structured architecture evaluation methods can be used to measure the strength of an architecture. They argue for their ATAM nine-step formal method to provide principal advantages, such as standardization, in a systematic analysis of architectures. Among the advantages of architecture reviews are the ability to ensure that the right architectural decisions are made; the ability to measure quality attributes such as performance, availability, security, and modifiability; and the ability to appropriately mitigate risks (Kazman et al., 2000).

The most convincing reason to do serious, high-quality architecture reviews is that the review guarantees the identification of architecture deficiencies, so corrections can be made earlier. Therefore, having a good architecture accelerates the IT development cycle. In effect, the review gives a clear understanding about the system structure and its components, and the ways that they are interconnected. This decreases

the percentage of errors significantly. The authors of this thesis believe that an estimation of the ROI for such an effort can be done by comparing the project to similar projects that have been done in the past without architecture review. Finally, the ATAM proposes to characterize quality attribute requirements by addressing the stimuli and response, the quantitative measurement of a quality attribute, and the decisions to be made across the architecture that impact the requirements. In the next chapter, a concept known as Quantifying Decision-Makers' Preferences (QDMP) is introduced as a tool that C4 can use in its architecture reviews.

In his article "Two Theories of Process Design for Information Superiority: Smart Pull vs. Smart Push," Hayes-Roth (2005) argued for the concept of "Valuable Information at the Right Time" (VIRT). Hayes-Roth (2005) argued through the use of "networks . . . to optimize information logistics." Hayes-Roth (2005) further stated how VIRT works: "Suppliers work with intelligent computing machinery to determine which bits should flow to which consumers, thereby integrating the information supply chain in a manner parallel to the recent advances in manufacturing" (Hayes-Roth, 2005). Essentially, the VIRT concept Hayes-Roth describes is aligned with the MCEN's vision of NCW, and shows the direction in which the MCEN seeks to move in the future.

However, it is important to note that VIRT must be implemented incrementally. Building this capability requires the integration of stakeholders, architecture, incremental methodology, delivery of incremental value, and continuous improvement (Hayes-Roth, 2005). When done incrementally, VIRT provides initially limited, but then expanded, capability with each subsequent delivery of VIRT-supported systems.

Stakeholders need to be participants in the development of the conditions of interest to ensure that their desires are articulated in VIRT development. The architecture needs to be modular in nature, which allows for evolutionary semantic development as the definition of "valued" information changes dependent upon the situation. Incremental methodology allows VIRT to be developed in stages by a predetermined stakeholder priority. Incremental value is delivered without the necessity of completing all the requirements before being employed. This provides the users with a reduced capability now, rather than a complete solution too late.

Continuous improvement is required to address opportunities within VIRT that may not have been originally designed but that still provide value to the stakeholders. The reason for moving towards the future incrementally is that if organizations try to implement information sharing across all agencies and the DoD, then there is a high risk of information overflow and of agencies being supplied with irrelevant information. By slowly introducing sharing between similar entities, there is a greater potential to increase common data, remove redundant metadata, and develop synergy between the entities. Successful implementation is when all defense agencies are appropriately merged.

In the Association for Enterprise Information (AFEI) Industry Task Force (2010) report, *Industry Perspectives on the Future of DoD IT Acquisition*, the AFEI sought to bring industry perspectives into the discussion of the DoD IT acquisition process. The AFEI's recommendation was as follows:

> The over-arching recommendation is to institute continuous, iterative, development, test, and certification processes that drive the commercial IT state-of-the-art to deliver more trusted, standard, off-the-shelf building blocks. In this model the ability to "bundle" trusted components becomes a critical unit of production. The DOD should begin implementation of the improved IT acquisition process immediately by chartering a number of independent, three-year pilot projects whose sponsors are incentivized for their own reasons to develop enterprise capability. These pilots will lead to a self-sustained persistent Development, Test, and Certification environment associated with a flourishing marketplace of "net-ready" re-useable components. (AFEI Industry Task Force, 2010, p. ii)

Essentially, the AFEI recommended shortening the IT process through the use of numerous pilot programs that allow systems to evolve modularly towards the direction the designers seek to drive the systems. The AFEI believes, along with Hayes-Roth (2005), that numerous programs, rather than one large IT research and development program, are a better solution to the problem of managing data from many stove-piped systems.

In the *25 Point Implementation Plan to Improve Federal IT Management*, Kundra (2010), the first CIO of the executive branch of the government, developed a set of actions to make rapid, incremental progress on the U.S. government's current IT

problems. Kundra (2010) noted similar concerns throughout the government in the IT acquisition process. Kundra (2010) asserted, "Federal IT projects will no longer last multiple years without delivering meaningful functionality. Poorly performing projects will be identified early and put under a spotlight for turnaround—those that continue to flounder will be terminated" (Kundra, 2010, p. 33).

Kundra's (2010) solution to the problem of IT acquisition is very similar to the solution proposed by Hayes-Roth (2005) and the AFEI Industry Task Force (2010); as Kundra (2010) explained, "The Federal Government will be able to provision services like nimble start-up companies, harness available cloud solutions instead of building systems from scratch, and leverage smarter technologies that require lower capital outlays" (Kundra, 2010, p. 33).

Furthermore, the U.S. CIO's plan addresses the personnel challenges of improving IT acquisition through the concept of building an integrated team composed of individuals with different types of expertise, that is, business process owners who have a clear vision of the problem they are solving, IT professionals who understand the full range of technical solutions, acquisition professionals who plan and procure needed labor and materials, and finance staff to secure required funding. Kundra (2010) also stressed that agencies need to allocate the required resources for projects from beginning to end.

Combining all of the previous concepts discussed on architecture and improving IT acquisition and portfolio management is Rideout's (2011) thesis, *Implementing a Modern Warfighting Supply-Chain for Information Technology Acquisitions*. In the thesis, Rideout highlighted that Robert Gates, the former Secretary of Defense, sought to change the acquisition of focus on requirements. The operational definition of requirements summarized in Rideout's (2011) paper focuses on the need to define requirements early; that is, the author highlighted the importance of defining initial objectives in detail, as opposed to the current method that focuses on final delivery capabilities. This methodology is best known as "open systems."

The best illustration of the use of the new, detailed initial requirements is a modular approach to developing large systems. Rather than sticking to the slow, laborious current process, which requires designers to forecast, in detail, years and even

decades into the future, the new process would stress building prototypes with today's technology and fielding and testing these systems as early as possible. This arrangement would allow the operational level to receive systems at a faster rate and allow them to evolve over time into the full capability required. By stressing the initial objective requirements, the DoD can field systems that are technologically feasible and/or currently available in today's commercial market.

The benefits of open systems are potentially quite numerous. Rather than allowing an institution's natural fear of change and advancements to lead to programs going technologically obsolete, this methodology embraces change. This is because open-systems methodology not only allows technological advances, but it also helps to plan them in advance to improve systems that are currently fielded. Through the use of open systems, large systems can be built upon the modular increments that are evolving to the final goal, which is also flexible. The warfighter receives the needed systems as early as possible and the enormous investment costs are spread out over the life of the system.

The risk of not changing the DoD's IT requirements is maintaining the status quo, that is, sticking to the processes that have put the DoD IT community in its current state. This leaves DoD IT systems and the entire defense architecture vulnerable to the modern threats to availability and accessibility on and off the battlefield. Rideout (2011) also pointed out that potential adversaries, such as non-state actors, do not have to deal with burdensome DoD regulations and can be swift and flexible in their equipment procurements, giving them a competitive advantage. Finally, if these strategies are not followed, the DoD runs the risk of not meeting the needs of the end users, because system requirements are determined too late to keep pace with adversaries' capabilities, and the systems they help design are obsolete when they are finally fielded.

Because of the convoluted industry definition of architecture, Rideout (2011) proposed a simplified definition for the IT realm: "A plan for assembling things based on a framework for integrating components" (Rideout, 2011, p. 4). Rideout's definition is useful to answer questions such as, "How can one economically reuse things? Or, how does one improve part of something without starting from scratch?" (Rideout, 2011, p. 4).

The best illustration of Rideout's (2011) operational definition of architecture is in its relation to natural selection. That is, the architecture fosters the ability to build upon the rapid technological developments of previous generations. If the IT enterprise architecture allows for investment, development, and maintenance of systems of systems and families of systems, heavy investment costs can be saved because the programs keep evolving rather than going back to the drawing board.

The main benefit of the architecture is the rapid development of planned systems integration due to reductions in schedule delays, reuse of components, system robustness and survivability, and, of course, savings in initial investment costs due to program managers addressing smaller portions of the desired system in an evolutionary approach rather than trying to develop complex systems in a stand-alone manner.

The first risk of not implementing this architecture concept is based on a cost versus benefits analysis—that is, cost overruns are inevitable without a low ROI as the DoD enters an era of fiscal restrictions. Inevitably, without a robust architecture, DoD IT systems will always lag (far) behind the private sector. The capability gaps will never be filled, IT standards will not be properly implemented and enforced, and, finally, the current and future systems will always lag in flexibility in the dynamic world of 21st-century operations (e.g., performance requirements, upgradability, integration).

Although Rideout (2011) proposes several beneficial ideas, one major drawback is that his target audience is limited. Rideout's (2011) IT supply chain is to be implemented at the execution level: "Synchronizing requirements, resources, and acquisition management to support this new agile model requires that stakeholders' current methods and mindsets change, especially at the middle management layer(s) [emphasis added]" (p. 26). Although it will require policy changes from the top of the DoD hierarchy, the transition must be driven from the bottom up by the middle-management/execution level.

In essence, if the stakeholders at the lower end of the DoD have buy-in, they can drive the effort forward, despite the numerous failed efforts at the top of the DoD. The authors of this thesis believe that if this transformation effort is driven from the bottom up, it will most likely fail, and the effort would be wasted. This would not be due to a

lack of effort, but the root of the problem is more complex than what can be solved by middle management. As Harvard Business Professor John Kotter (1995) noted, often transformation efforts fail when there is no buy-in at the top of the organization.

The first two chapters of this thesis were a summary of the ongoing development of a Marine Corps–wide enterprise architecture approach for assessing the IT planning and investment process, including IT-related programs of record. The enterprise architecture-approach to enterprise architecture known as the Marine Corps Information Enterprise Technology Strategy (MCIENT-S) is intended to transition Marine Corps into the 21st century by providing Marine Corps leadership with superior decision support. The study begins with a baseline understanding of the current financial environment of enterprise architecture; from the initial and rapid growth in defense-specific IT acquisitions since 9/11 into the current fiscally constrained environment of FY2013. The rising trend of the last decade of defense (IT) investment yields its own unintended consequences.

The previous literature evaluated planning and implementation strategies against ROI by analyzing the current and proposed additional IT investment performance metrics to enhance the enterprise architecture. From reviewing prior literature, the researchers learned of the need to conduct an organizational analysis of the Marine Corps IT development and portfolio management process.

III. RESEARCH METHODS

In this chapter, the researchers discuss the methods used in later chapters to examine and analyze the current "as-is" model of interactions between C4 and other agencies like MCCDC and MCSC, as well as provide a blueprint for the proposed "to-be" model. This thesis first assumes that any issues identified with C4 and its interactions with other Marine Corps' entities are not technical in nature but rather organizational. Therefore, this thesis employs strategic management (SM) frameworks to guide the analysis that helps lead to the proposed model. Second, the qualitative results from the SM analyses require a quantifiable method to produce actionable recommendations. To this end, a method called Quantifying Decision Makers' Preferences is introduced in this chapter and is delineated in later chapters for application to the problems uncovered by the authors' research.

A. THE STUDY OF AN ORGANIZATION USING STRATEGIC MANAGEMENT FRAMEWORKS

The underlying assumption in the use of SM frameworks is that the issues within an organization and between different entities within an organization are not technical in nature, but rather stem from human interactions. These issues may lie at the micro level, where an individual's motivations and actions are out of alignment with his or her organization's immediate needs, or may exist between separate entities within an organization seeking different results, outcomes which may be at odds with each other. Although many SM analytical frameworks exist, three of these inform this research: the Stakeholder's Analysis (SA), with support from the Five Forces Analysis (FFA), and the Congruence Model.

1. The Stakeholders and Five Forces Analyses

The work of Freeman (1984) establishes the SA as a framework useful for the private sector. Stakeholders are those entities that can either add to or detract from an enterprise's value; whether or not they are an official part of the organization is irrelevant. The usefulness of this concept lies in its ability to identify actors who conventionally are not thought to have any impact on an enterprise. The public, non-

governmental organizations, the media and other influencers, and various actors along a company's supply chain are examples of players who can influence the valuation of a corporation and yet are outside the organization and are typically not considered in other SM analyses. These stakeholders can be modeled as outside influences on an organization's success, as shown in Figure 8.

Though public-sector entities lack the profit-making function that leads to a useful monetary valuation (e.g., stock share price) of private-sector organizations, public-sector entities, such as C4, can still be quantifiably valued in other manners, making the SA a useful method for this thesis. To this end, the researchers have sought to identify those actors external to C4 who can impact the valuation of the subject organization by influencing the way in which C4's outputs are perceived and then translated into inputs for use within external agencies and beyond. By mapping the C4 product as it exits that organization and then passes through others, where it will be used in its original form, translated, or ignored, one can better determine the impact, and thus the valuation, of C4.

In order to bend the private sector-oriented Stakeholder Theory to meet the needs of this public sector-focused analysis, the researchers used another model to better understand C4's role within its family of Marine Corps entities, which includes MCCDC, CD&I, and MCSC. The other model is Porter's FFA (Porter, 2008), shown in Figure 9. This framework aids in building an understanding of where, within the industry, an organization lies in relation to its suppliers, customers, competitors, potential substitutes, complementors, and new entrants (Porter, 2008). Using this analysis, one can better understand how C4 relates to its fellow Marine Corps entities so that he or she can then conduct a more effective SA. Of value to this process is the concept that ideas and information serve as substitutes for the more concrete products and services that exist as the lifeblood of the traditional FFA.
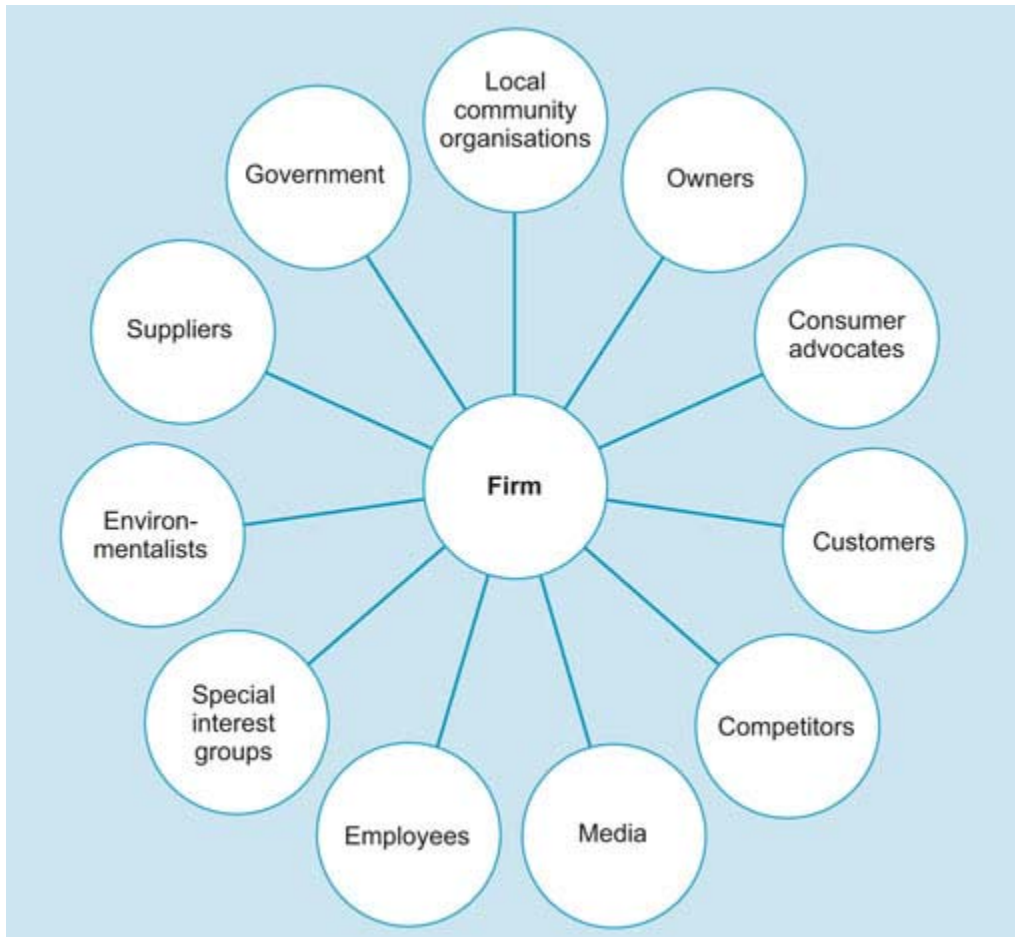
Figure 8.   Example of a Stakeholder Model for a Given Firm
(Freeman, 1984, p. 25)

By understanding how the intellectual capital flowing out of C4 relates to and is utilized (or not) by the other agencies, the capital's eventual value to the Marine Corps is better appreciated. By understanding the nature and level of this influence, this thesis can better identify any ways in which the work of C4 is under- or misused by the other Marine Corps entities, and, thus, can ultimately find ways in which C4 can be more effective in supporting the Marine Corps.

The Five Forces That Shape Industry Competition
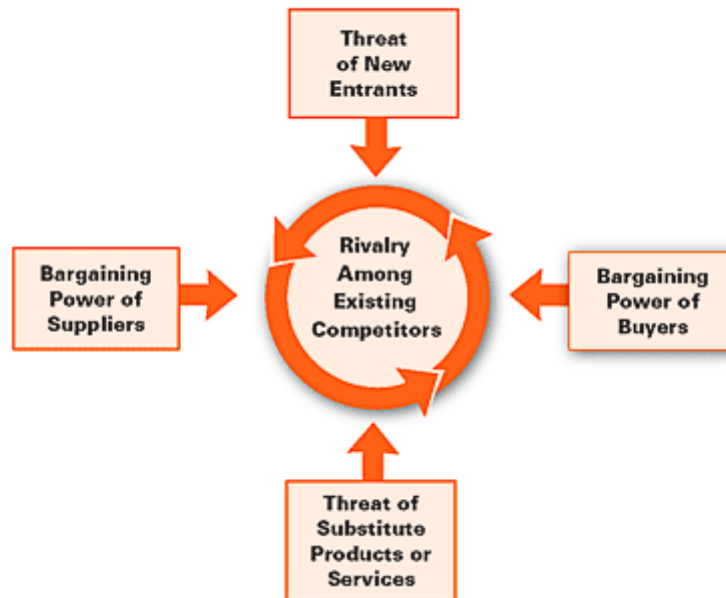
Figure 9.   The Five Forces Model
(Porter, 2008, p. 80)

An example of the usefulness of these two frameworks is the case of IKEA and its issues during the mid-1990s with selling carpets made from child labor (Bartlett, Dessain, & Sjoman, 2006). The furniture company was selling carpets that had been supplied from India and Pakistan, a proportion of which had been manufactured using child labor. IKEA spent years determining methods to ensure that none of the products it sold were produced in such fashion, during which time the company was continually trying to understand its place in a complex system.

An FFA first identifies IKEA's position in relation to its industry: that its suppliers' identities and methods at first were largely unknown, and that its customers possessed considerable awareness of the issues and a desire not to contribute to objectionable practices. Left unchecked, both of these forces held great sway over IKEA's business prospects.

An SA expands this understanding by identifying other actors that could add or detract from the company's value: a global news media, which could leverage networks and information, and present damaging issues to the public before IKEA was even aware of the problem, and much less able to respond; non-governmental organizations, which

could either aid the company in determining solutions or could further denounce IKEA's actions if they were not deemed in good faith; and the general public, some of whom may not be potential IKEA customers but whose opinions might negatively influence those who would otherwise do business with the company.

By identifying these many relationships and their dynamics, IKEA was able to use the information gained from some of these actors to change its practices and, ultimately, influence its stakeholders for the better. This thesis will apply this concept to the public-sector world of C4 to identify how this entity can modify its outputs and, thus, alter its relationships with its stakeholders for the better.

2. The Congruence Model

Oliver Wyman Delta's (2011) Congruence Model aids in understanding the dynamics and performance of an enterprise before making any attempt to diagnose the nature of an organization's problems. The value of this model lies in its ability to help describe a dynamic organization, rather than one that changes slowly. C4 is ripe for such an analysis, given its exposure to fast-paced organizational change that itself stems from the combination of swift changes in communications technology and the evolving threats—and the perceptions of and responses to these threats—facing the U.S. and its military.

The Congruence Model is useful in its support of the SA in that it builds upon the same technique that the FFA initially provides by identifying in detail the resources, cultures, individual people, histories, and environments that shape both the inputs into the subject organization and also the outputs. This level of detail is useful because it helps to identify the potential triggers of change in a complex organization. It recognizes the human elements of an entity's processes and seeks to understand how these impact both the subject organization as well as external entities that may be stakeholders to the subject's outputs. Combined with the FFA, the Congruence Model (Figure 10) aided in the use of the SA of C4, the findings of which then help in determining a solution to the issues discovered.
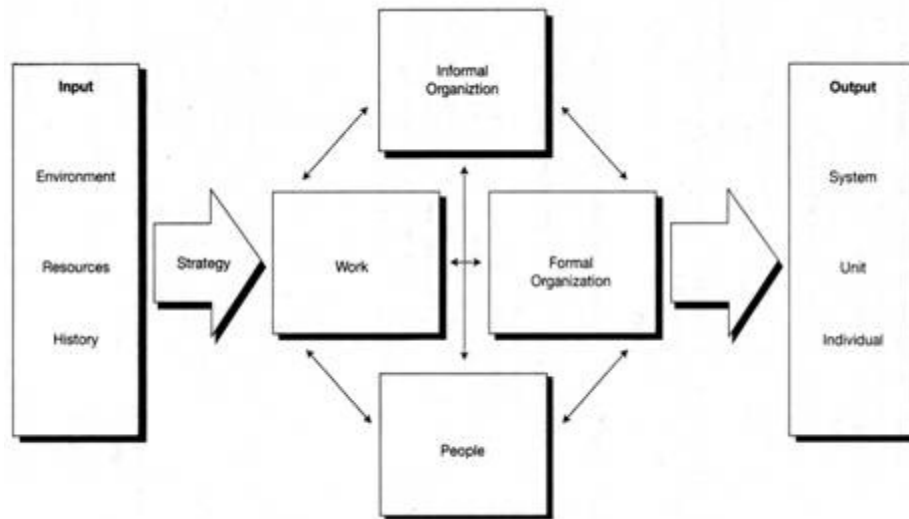
Figure 10.   The Congruence Model
(Oliver Wyman Delta, 2011, p. 12)

B.   THE APPLICATION OF QUANTIFYING DECISION-MAKERS' PREFERENCES IN DETERMINING OPTIMAL SOLUTIONS

Prior to using the three described SM frameworks to diagnose the situation, this thesis' research plan had included the use of the QDMP method to prescribe a way forward. Chapter IV describes the use of these frameworks, and Chapter V discusses how the findings were such that QDMP was unusable for this thesis. However, as is also discussed in Chapter V's recommendations for future research, this methodology will still be valuable for further research, and so it is described here using a notional example.

The QDMP method is a simple tool used to determine the best course of action from among a set of choices, provided that the framework is set up with consideration of the likely costs and benefits from any hypothetical solution, and that sophisticated decision-makers provide input to the process (Kirkwood, 1997).

The benefit of this process is that the weights and measures established prior to the introduction of real-world choices are determined without the biases of the actual solutions. This means that when the real-world choices are applied and measured, an unbiased best choice emerges, having arisen from a transparent process in which all players understand how the decision was formed. To achieve this ideal end state, the establishment of the weights and measures of the given QDMP system must be made by

first breaking down the decision into its various components, and then subdividing these until all portions can be quantitatively measured. These portions are then weighted according to their value, either to their higher echelon components or to the decision itself. Once the system is agreed upon by decision-makers, the actual potential solutions can be applied, and the winning choice will have been vetted with fairness and transparency (LaCivita, 2011).

Following is a notional example of how a QDMP process can be conducted, and how it would have been applied later in this thesis, but can still be used in future research. Currently, the four main branches of the United States Armed Forces (Army, Navy, Air Force, and Marine Corps) each have their own, entirely separate set of databases for personnel administration, which include various websites serving as portals through which Service members can view or update their personal information. This personal information includes, but is not limited to, training records, next-of-kin, home-of-record and dependent information, awards, pay information, performance evaluation reports, medical information, insurance records, and GI Bill records. Online training requirements also factor into these families of systems, so that these systems are not only passive repositories of information but must be designed to handle heavy user interaction as well. According to the DoD CIO (2012), the problem is that in a period of both dramatically rising IT costs and joint operations, the existence and maintenance of disparate systems is expensive and does not support sufficient coordination among the Services (Takai, personal communication, August 23, 2012).

Simply, these databases and systems do not "talk" to each other, and the DoD wastes money and effort on duplicated efforts. As an example of wasted money, the Army Knowledge Online system's FY2011 budget was nearly $90 million. If each Service has a similar investment in its online training and education systems, and a substantial portion of each system's cost is overhead, then the savings realized from combining these systems is significant.

An example of wasted effort comes from the Naval Postgraduate School's (NPS) former senior Marine representative, LtCol Pangelinan, who had to bargain with systems administrators for many weeks to get the NPS dean placed on the Marine Corps' Marine

Online system so that he could review Marine student evaluations (V. Pangelinan, personal communication, March 2011). These examples show the costs and inefficiency the DoD suffers under the current system.

1.   Goals and Objectives

The goals of this cost-effectiveness analysis (CEA) are to improve the overall quality and lower the costs of IT systems supporting DoD personnel. Overall quality is defined as the quality of the systems as a whole, which is dependent on how well systems operate together and how well they enable sufficient data flow. The objectives are to maximize interoperability between the Services, minimize acquisition and maintenance costs, and minimize the losses of existing data and non-technical processes. From here, this CEA moves onto the different possible options to solve the problem, and then moves on to addressing constraints, assumptions and other factors in the process of determining the best way to measure solutions.

2.   Alternative Solutions

The three competing alternatives are to (1) maintain the current suite of systems, (2) create an entirely new, "purple," system, completely scrapping the legacy systems and consolidating all the data and processes onto the new system, and (3) create an interface between the legacy systems, so that they remain in existence but are interoperable, and become in effect a consolidated system.

3.   Constraints

Although the objective with this CEA is to lower costs, the second two alternatives are long-term objectives whose up-front costs would be extraordinarily high, discouraging politicians and senior Service members from endorsing these plans. Culturally, members of the different Services are very wary of each other and would likely get into turf wars if forced to share systems. Thus, budgetary, political, and cultural constraints are high, while technological constraints are low (i.e., the technology exists; it's just a matter of the DoD and the U.S. government committing themselves to a long-term project and the sacrifices it will entail).

4. Assumptions

In this CEA, it is assumed that each of the current systems possesses sufficient quality when viewed as stand-alone systems. The goal of this CEA is only to lower overall costs and improve the quality of all the systems when viewed together as a super-system. So, this CEA is not designed to improve an individual system, but to improve how all the systems operate and share data and processes together.

5. Unintended Consequences

One consequence of systems integration accounted for in this CEA is lost data. The second two alternatives could quite conceivably lead to the loss of legacy data, and thus the mitigation of this event is one of the objectives. Another consequence is the potential changes made to how each Service administers itself, which underlies the processes inherent in databases, systems, and websites. This factor is considered in the mentioned objective requiring the retention of existing processes organic to the Services. A third unintended consequence is that the capabilities that would purportedly be gained from either of the second two alternatives could be too permissive and be exploited for insidious advantage. So, this CEA must also consider the additional costs needed to secure the new system.

6. Weights and Measures for the Objectives and Their Criteria

The situation, then, is that the U.S. government must either find a better alternative to the current system of DoD-personnel-oriented IT systems, or show that the current system is the best solution. The problem statement is this: "Determine the most effective solution." In order to measure effectiveness, the QDMP process must break down the CEA's objectives until they become measureable criteria. This CEA's initial objectives are as follows in this section.

The analysis first begins with interoperability. Although each DoD Service assumedly has systems that provide sufficient visibility and the ability to act for their own users, the purpose of this CEA is to determine whether it might be more effective to consolidate legacy systems, and so the following measures of effectiveness must be applied to either of the second two alternatives described previously.

Visibility is defined as the ability to view the same information, which has a sole and singular origin, across different systems or parts of a system. Aside from the ability to simply see the data (mere existence), another part of the requirement for a system to have full visibility is that of fidelity, or whether the information being viewed is the same as that information at its source, assuming that the system ought to replicate it in the first place. Visibility can thus be measured as a rate of how often information that ought to be replicated across the network actually is replicated. Visibility would be tested by sampling a random, diverse, and representative set of new or updated data sets (new test scores, updates on dependent information, new evaluations, training updates, etc.) and then compiling a success rate.

This testing of visibility would answer a Service member's question, "If I want to view the training record of a subordinate from another Service, how likely will it be that the record will be viewable to me in the first place, and how likely is it that the record will be up to date, and accurately reflect the source document?"

Fidelity, a component of visibility, also depends on the speed of replication. And so if the Service member who asked the question in the previous sentence could indeed view the record, but some aspects were out of date when the source document (residing elsewhere in the system) showed they had been changed, it would help the Service member to know the rate of the speed of replication in order to answer the follow-up question, "Then how soon will my view of the record reflect the source data?" Fidelity is then also a measure of timeliness, which in this CEA will be scored as follows: a score of 1 if the record is accurate when first checked; a score of 0.75 if, after checking the record and finding it inaccurate, it takes less than a week to rectify; a score of 0.5 if it takes fewer than two weeks to rectify; a score of 0.25 if it takes fewer than four weeks to rectify; and a score of 0 if it takes longer than four weeks to rectify. These numbers' significances lie only in their relative value. That is, applying a given alternative with a higher number to a relevant component will make this component more cost effective than it would be if decision-makers chose an alternative with a lower number.

The ability to act is defined as the capability to make a change that will replicate across the enterprise, given that a user has permission for such action in the first place.

This criterion can be broken down into measures of effectiveness in the same way that visibility was broken down, and these would answer the question, "If I want to make a change to the record of a subordinate from a different Service, how likely is it that I can make the change (existence), and how likely is it that the change will be reflected in those places that it should, in its entirety (accuracy), and in a timely manner (timeliness)?" As with visibility, these measures of effectiveness are represented as success rates based on tests.

The next objective in this CEA is minimizing system costs. Although these are more easily measured on a yearly basis, assuming good cost-estimation techniques, this process also proves to be slightly problematic as the up-front costs of the second two alternatives exceed the annual costs of the current systems, although the alternative's costs later decline below those of the current systems. In this CEA, the estimated costs of a five-year period for each alternative will be used, accounting for net present value. Although both the public and private sectors typically look for payback within three years from IT investments, the magnitude of this hypothetical initiative allows for some lengthening of this time frame. As the status quo, the current system will be assigned a score of 0.5 (its projected five-year costs are $12 billion), and the other alternatives will be scored relatively, as follows: if, after five years, an alternative has cut the cost in half, that alternative will receive a score of 1 for costs; if, after the allotted time, the costs have doubled, that alternative will receive a score of 0.

The final objective deals with retaining legacy data and processes, which are both technical (dependent on databases, networks, and their interfaces) and logical (the human processes that exist either outside or through the technical processes). Retention will be measured again as success rates based on samplings of data and processes after transition to determine whether data was retained at all, and if so, what its fidelity level was. Figure 11 shows the hierarchy of objectives within this CEA.

Figure 11.   Measures of Effectiveness of a Given DoD Personnel Administration System

The next step in this CEA is to assign weights to each of the criterion and to each subsequent measure of operational effectiveness.   Based on assumed decision-maker preferences, this analysis will assign two fifths of this initiative's importance to interoperability, two fifths to costs, and one fifth to retention (LaCivita, 2011). That is, interoperability and costs are equally important, and each is twice as important as retention of data. Thus, interoperability, costs, and retention will have weights of 0.4, 0.4, and 0.2, respectively. This decision is based on the fact that the goals of this CEA are to improve quality (defined as interoperability) and lower costs (LaCivita, 2011). Although data retention is one of the objectives of this CEA, it exists only as a mitigating factor (a relevant cost), and given that data and process loss are expected from such an initiative, they are of lesser importance than the other two objectives in informing the final decisions of leadership. Within the objective of retention, data will receive 0.8 of the value, considering that as long as it is retained, the system can continue operating and users will be served, even with some delays; processes will receive an importance of 0.2. So, the retention of data is four times more important than the retention of processes (LaCivita, 2011).

After assigning values to the objectives, we move on to the measures of effectiveness, beginning with those measures under interoperability. Again based on decision-maker preferences, visibility is assigned an importance of 0.6, while the ability to act is valued at 0.4 (LaCivita, 2011). This is based on the notion that at least knowing something may make up for the fact that one cannot act upon it. Beneath these measures within the hierarchy, existence earns a 0.9, and fidelity has an importance of 0.1, based on the overriding importance of something existing in the first place, which then can be further measured. As a further measure of fidelity, accuracy receives an importance of 0.7, while timeliness is valued at 0.3 (LaCivita, 2011).

Going back to the measures of effectiveness in valuing retention, here fidelity for both data and processes receives a higher importance of 0.5, given that this is source data that cannot otherwise be retrieved, while the data considered when measuring interoperability is only reflective of source data, which is still assumed to be intact elsewhere in the enterprise. In other words, data considered under the retention objective will be just as useless if it is corrupted as if it was simply lost. Existence of this data then also receives a 0.5 (LaCivita, 2011). Figure 12 shows the hierarchy of objectives now with assigned weights.

Figure 12.   Weighted Measures of Effectiveness of a Given DoD Personnel Administration System

7. Evaluating the Alternatives

The next step in this CEA is to consider the alternative solutions discussed earlier. These include the current system (the status quo) and the two proposals for restructuring the DoD suite of databases and websites. In this scenario, two contractors have come forward, each with a proposal for Alternatives 2 and 3. So, this CEA now has five different alternatives. Experimental programs by the contractors were reviewed on how well each proposal would fare given the different measures of effectiveness, and calculated costs over a five-year period. The results are shown in Table 1.

Table 1.   Evaluations of Alternative DoD Personnel Administration Systems

Objectives			MOEs		Alternative 1	Alternative 2 /Contractor 1	Alternative 2 /Contractor 2	Alternative 3 /Contractor 1	Alternative 3 /Contractor 2
Inter-Operability	Visibility		Existence		0	.7	.8	.6	.7
		Fidelity	Accuracy		0	.4	.7	.4	.6
			Timeliness		0	.2	.3	.1	.2
	Ability to Act		Existence		0	.6	.7	.5	.6
		Fidelity	Accuracy		0	.3	.5	.3	.5
			Timeliness		0	.3	.4	.2	.3
Costs					.5 ($12 billion)	.1666 ($20 billion)	.208333 ($19 billion)	.41666 ($14 billion)	.458333 ($13 billion)
Retention	Data		Existence		1	.8	.7	1	.9
			Fidelity		1	.7	.7	1	.9
	Processes		Existence		1	.7	.6	.9	.9
			Fidelity		1	.6	.5	.9	.8

All of the scores shown in Table 1 are based on the combined and averaged success rates for each of the measures of effectiveness. For instance, for Contractor 1's proposal for Alternative 2, the contractor provided an experimental program, and government testing revealed that, when measuring the existence of visibility, data had been replicated and was viewable close to 700 out of 1,000 times, giving a score of 0.7. In addition, when data that should have been replicated was not, it took slightly more than a month to fix the problem and have the source data replicated across the enterprise.

Costs, at least with the given proposals, exceeded the five-year total for the current system, but this is not a critical criterion, as it is understood that in years beyond the first five, the systems provided by such proposals would eventually break even in costs with the current system.

The results of all five alternatives are shown in Figures 13–17.

Figure 13.   Measures of Effectiveness of DoD Personnel Administration System, Alternative 1

Figure 14.   Measures of Effectiveness of DoD Personnel Administration System, Alternative 2, Contractor 1

Figure 15.   Measures of Effectiveness of DoD Personnel Administration System, Alternative 2, Contractor 2

Figure 16.   Measures of Effectiveness of DoD Personnel Administration System, Alternative 3, Contractor 1

Figure 17.   Measures of Effectiveness of DoD Personnel Administration System, Alternative 3, Contractor 2

In this CEA, Contractor 2's proposal for Alternative 3 (the plan to build an interface linking the legacy systems) came out as the best choice, given the set of criteria, their relative values, and the results of testing plus cost estimation.

8. The Final Decision

The final decision by DoD decision-makers must consider the trade-offs between the various criteria. The main difference between the two contractors is that one can deliver better interoperability at lower costs, while the other can retain more legacy data and processes. Under the current weighting, Contractor 2's proposals turn out to be more favorable. However, if the decision-makers decided that retaining legacy data was more important than they had realized, then the latter's proposals might be viewed more favorably. The importance of costs is highly susceptible to the budget environment of the time. What is too expensive at this point may be of no issue a half century from now. The decision-makers may also come to believe that as long as payback is guaranteed at some point in the future, then costs are of much lower importance in this process than we have assumed in this CEA.

Though the two contractors in this CEA are hypothetical, their utility is in forcing the decision-makers to come to terms with what they have stated is important to them. By witnessing how the ratings of visibility, timeliness, and costs interact with each other and form a composite score, they can better understand the consequences of statements like "keeping costs down is just as important as anything else," or "retaining our legacy data and processes isn't much of a concern."

The final decision would be made by going through more scenarios, fine-tuning the weights of each objective, going into more detail, and coming up with a final hierarchy to use in inviting contractor bids. By specifying in this manner what is required of a future IT system, the DoD can improve the overall quality and lower the costs of IT systems in support of DoD personnel.

Thus, the QDMP process was useful to this scenario, as it first decomposed a high-level problem into manageable components, which could then each be assigned values in an understandable and transparent manner. Although the findings from the

other frameworks used in Chapter IV did not allow the use of the QDMP process in forming recommendations, this analytical method can be viewed as useful in any future research.

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IV. RESEARCH AND ANALYSIS

A. STAKEHOLDER'S ANALYSIS OF THE DON CIO CASE STUDY

This chapter begins with a discussion of the research conducted before, during, and after the researchers' trip to C4 in January 2012. As discussed in the literature review in Chapter II, the broad context of this research is an analysis based on the theories surrounding the field of organizational behavior, particularly that of the concept of the SA.

In the discussion regarding the organizational structure of C4, it was mentioned how the Director of C4 has two major command relationships in the realm of IT procurement and management. One is vertical (with DoN CIO) and the other is horizontal (with P&R, MCCDC, and MCSC). These relationships are analyzed in this chapter to ascertain the extent of congruence, or lack thereof, in the current structure.

1. The DoN's Enterprise Architecture and Stakeholders

From the vertical relationship, the DoN CIO has set a precedent to conducting periodic the SA. In *CHIPS*, the DoN's information technology magazine, Victor Ecarma and Fumie Wingo (2011)—members of the DoN CIO emerging technology team—noted the success that DoN CIO has had with the Navy enterprise architecture from the stakeholder's perspective. As stated, the enterprise architecture has assisted "DON program managers in the development of 'solution architectures,' as mandated by the Joint Capabilities and Integration Development System and Defense Acquisition System processes" (Ecarma & Wingo, 2011). The authors noted that this process, which they title as an annual DoN IT/NSS system assessment, appears to be successful since its implementation in July 2009.

One might ask, "How has the Navy enterprise architecture been so successful in aligning the values of its stakeholders, while simultaneously meeting the warfighter's requirements, as noted in the JCIDS process, and also making its portion of the acquisition process more efficient?" The answer, according to Ecarma and Wingo (2011), is the integrated aspect of their architecture. The authors noted that during every

initial, and particularly during annual stakeholder reviews, these "solution architectures" are analyzed on the legal requirements of

> a DON Information Management/[IT] (IM/IT) Investment Annual Review … to include all four mission areas: Business Mission Area (BMA), Enterprise Information Environment Mission Area (EIEMA), Warfighting Mission Area (WMA), and Defense Intelligence Mission Area (DIMA). A Title 40/[CCA] Confirmation. Title 40/CCA Confirmations are required for all Information Technology/National Security Systems, prior to each formal acquisition milestone, contract award and deployment and fielding decision. DON NIPRNET public key enablement (PKE) waiver request. (Ecarma & Wingo, 2011)

Consequently, these requirements and assessment results are placed into an automated database prior to the IT acquisition process. This datastore is known as the DoN version of the DoD Information Technology Portfolio Repository. The current Navy enterprise architecture "requires acquisition category (ACAT) programs to document their solution architectures in a particular way and/or to make use of DoN enterprise architecture artifacts as their starting point" (Ecarma & Wingo, 2011).

In the last two years, the Navy has moved past its annual review and DoD IT Portfolio Repository (DIPR)-DoN database into developing the Business Case Analyses (BCA) with the intent of implementing even more stakeholder involvement. Using the principles developed by DoN CIO researchers such as Groce, Fischbeck, and Mahdi (2012), the Navy enterprise architecture has been able to build upon its stakeholder's recommendation in its annual review. According to the DoN CIO, "BCA methodology was developed collaboratively using an inclusive process to ensure perspectives from stakeholders across the DoN's technical and business IT communities, as well as other enterprise stakeholders, who have years of technical and customer experience" (Ecarma, 2009, p. 30).

In essence, the purpose of the BCA is for the integrated product teams (IPTs) to implement the most effective and efficient architecture at the earliest possible stage, prior to development. In the following paragraphs, the researchers demonstrate how this model is reflected in the Marine Corps' IT procurement and portfolio management by conducting a stakeholder's analysis as well as analyzing the organization for congruency.

Note that the data utilized in the SA and the Congruence Model primarily came from interviews conducted on site at Headquarters Marine Corps (C4, P&R, and MCCDC).

B. STAKEHOLDER'S ANALYSIS OF C4 AND ITS RELEVANT PARTNER ENTITIES IN ITS PROCUREMENT AND PORTFOLIO MANAGEMENT

1. Defining the Organization and Its Functions Pertinent to IT Planning and Program Management

The Marine Corps C4 department plans, directs, and coordinates all staff activities relating to communications and IT functions, and supports the CMC in his role as a member of the Joint Chiefs of Staff. As the CIO of the Marine Corps, the Director, C4 provides oversight of Marine Corps IT infrastructure and governance and of the policy of Marine Corps IT, and represents the Marine Corps at federal, DoD, joint and DoN IT forums.

The C4 department is, therefore, to the Marine Corps what an IT department or a CIO is to any sizable private-sector organization, in that it serves as the CMC's (and in the private-sector's case, a chief executive officer's [CEO's]) agent for planning, supporting, and directing IT functions, and generally enabling communication within the organization. Just as a corporation's CIO might advise the CEO and other company leaders on which data storage system to procure, or how to use social media to reach potential customers, so might the C4 department advise the CMC and his deputies of any IT considerations for converting to new expeditionary energy sources, or how best to convert to a new enterprise email system.

2. Defining the Organization's Environment, Including Its Relevant Partner Entities in the Acquisition Process

The Director, C4 is also the Deputy DoN CIO (Amos, 2010b), and, therefore, has many channels of communication, including those going higher to the CMC and the DoN CIO, and those existing laterally with sister Services and other federal entities. Within the Marine Corps, C4 has the task of providing support for the outcomes of the Marine Corps' acquisition process, working in concert with other Marine Corps agencies, such as MCCDC and MCSC. C4 also provides subject-matter expertise and input for this process

during its initial planning stages and accomplishes this with assistance from the functional area managers (FAMs) and the Marine Forces (MARFORs).

The FAMs are responsible for the 13 different functions within the Marine Corps (such as intelligence, logistics, and personnel management) and the six within the Navy that each have communications requirements and considerations (Nally, 2010). And so the FAMs are required to represent the interests of these functional areas to C4, and this process is part of C4's portfolio management activities, required to meet its mission of coordinating and supporting all Marine Corps IT functions and governance (Amos, 2010b).

This responsibility to coordinate with other elements of the Marine Corps is again analogous to a private-sector CIO or IT department in that a given corporation's departments or divisions each have communications needs that require the CIO's support and input from the initial planning stages throughout its life cycle. Thus, given the ubiquitous nature of IT, C4 is heavily involved in the Marine Corps' programs of record.

Although C4 is focused on sustaining and improving the Marine Corps' portfolio of IT capabilities, it exists within the acquisition environment. Because acquisition encompasses the design, engineering, test and evaluation, production and operations, and support of defense systems (Brown, 2010, p. 1), and these systems are composed of many aspects other than IT, C4's voice is just one of many influencing the Marine Corps' acquisition decisions. This means that C4 has only partial control over its IT portfolio.

This again could be considered to be similar to the environment of a private-sector organization's CIO or IT department. Because much of the funding and decision-making authority is held outside the IT department, and other divisions or departments within the company may spend money and acquire systems and capabilities contrary to the IT department's counsel, the CIO may find itself operating and sustaining systems it never sought and which are counter to its strategy. This issue as it pertains to C4 will be discussed further in the FFA.

The Marine Corps acquisition process is composed of MCCDC, which determines the Marine Corps' needs and decides what will be procured (Marine Corps Combat), and MCSC, which executes these decisions and fulfills acquisition orders (Marine Corps

Systems). Although these two agencies come to and implement decisions as part of the top-down portion of the JCIDS process, the initial requirements they work with are raised from several places within the DoD and the Marine Corps structure. One is from C4 and the MARFORs, partially through the IT Steering Group (ITSG), and the other is from the combatant commanders, as part of the JCIDS' Integrated Priority List process (Brown, 2010, pp. 56–57).

Private-sector vendors, and even sister Services within the DoD operating through the JCIDS process, can also influence the IT perspective of the acquisition process, so that even when discounting the credence given other functional areas (intelligence, logistics, etc.), C4 still faces competition within its own functional area for influence over the acquisition process. This can greatly and negatively affect the composition of the Marine Corps' IT portfolio.

3. A Five Forces Analysis of HQMC, C4's Position Within the Marine Corps Acquisition Environment

Before using an SA to understand the influence that MCCDC, MCSC, and other entities have on C4's value, a brief FFA will be conducted to establish each entity in its proper role.

a. The Industry

Because C4 is the subject of this research, it will serve as part of the industry for this analysis. C4's primary role under the current arrangement is as an executor of decisions made earlier in the acquisition process by MCCDC and MCSC. Though C4 also plays a role in influencing these two entities with its subject-matter expertise, it has no final authority over acquisition decisions affecting the Marine Corps' IT portfolio and is, therefore, left holding the role of supporting the decisions made, whether these are aligned with C4's recommendations or not.

C4 finds itself in this position because actual expenditures and purchases made by the Marine Corps are executed through programs, of which IT systems are only components. According to Lieutenant Colonel Karl E. Hill at P&R, because "there's no money associated with (portfolio management), there's no teeth and no bite" (personal

communication, January 2012). Without controlling programs, C4 ultimately has no control over its own portfolio. "Money is all done programmatically, so the huge disconnect is we have this large churn at ITSG and (with the) FAMs" (K. E. Hill, personal communication, January 2012). Though C4 invests a considerable amount of time in the ITSG process, its suppliers are not bound to follow suit and can discard its findings and recommendations.

C4's industry under this analysis is, therefore, a customer to its suppliers, MCCDC and MCSC, and is charged with adding value to the decisions made and programs executed by these two agencies. C4 has no direct competitors within this industry, although further analysis shows how entities from other areas of the Five Forces compete for its role in influencing its customers.

b.   Suppliers

As a member of the JCIDS process (Brown, 2010, p. 37), MCCDC enjoys its role as the originator of acquisition decisions within the Marine Corps. Although it receives much of its understanding of requirements from the MARFORs, Combatant Commands (COCOMs), C4 and the other Marine Corps FAMs, it sits at a crucial spot in the joint, top-down Capabilities-Based Assessment (CBA) process that ultimately starts with guidance from the President, the Secretary of Defense, and the Joint Chiefs of Staff (Brown, 2010, p. 36).

The MCSC likewise holds much power over its customers due to its funding authority. C4's suppliers, therefore, greatly determine what programs it will help support, and C4 cannot alter these to fit its own interests as it passes them along to its own customers.

c.   Customers

C4's customers in the analysis are the MARFORs, and the Marine elements operating under the COCOMs, and are so in the sense that they receive subject-matter expertise and assistance in implementing and operating the systems and programs that come out of MCCDC and MCSC. Although these two agencies originate and supply

the products that Fleet Marine Forces (FMFs) will eventually use, C4's role is to add value to these by providing guidance on their implementation and use.

One way in which the customers in this analysis can marginalize the industry's role is by receiving a disproportionate share of their support from the industry's own suppliers. MCSC, for example, in the introduction of a new or upgraded system, can work extensively with some FMF unit in its implementation, and C4 may not be a part of this process at all, after providing initial guidance. Similarly, contractors supporting systems in the field with FMF units have their counterparts not in C4, but with MCSC, where the program is located. Thus, depending on the program, C4 can be effectively cut out of the implementation phase of a system, leaving it with little bargaining power between its suppliers and its customers.

d. Substitutes

Substitutes in the FFA are those entities that exist outside the industry structure yet can still assert themselves in the industry's role and interact to the industry's detriment with either the suppliers or customers. The availability of commercial off-the shelf (COTS) IT to commanders in the FMF allows them to bypass the normal Marine Corps acquisition process, including C4's role, in procuring equipment. This makes the COTS IT providers a substitute in this analysis, as they exist outside C4's industry, yet can marginalize the value that C4 adds to the MARFORs.

e. Summary

C4's suppliers have complete freedom to implement programs that run counter to C4's desires for the Marine Corps' IT portfolio. Meanwhile, its customers do not need to completely rely on C4 for oversight or for their equipping requirements, owing to both the power of the industry's suppliers and the role of substitutes. This leaves C4 in a marginalized role within the Marine Corps that diminishes its value.

4. Analyzing How These Entities Either Add to or Subtract From Marine Corps C4's Value

Having identified MCSC and MCCDC, the MARFORs and COCOM Marine elements, and the COTS IT providers as C4's stakeholders, their individual and

collective impact on C4's value will now be analyzed. First, however, the researchers introduce another set of stakeholders which were not a part of the FFA, due to their being outside of C4's direct processes, while still having their fates tied to C4's.

This last group is composed of the other DoD Services, whose acquisitions processes relate to the Marine Corps through the JCIDS process. Although the Marine Corps' acquisition process is specific to its Service, the needs of the other Services may still dictate what the Marine Corps procures and what the MARFORs and Marine elements in the COCOMs might end up owning and operating. And again, the resulting technology portfolio might be at odds with C4's envisioned IT portfolio.

The work of Johnson and Scholes (1999) established a simple matrix model to depict the power that the stakeholders may hold over the subject organization, and the level of interest these stakeholders have in the subject's work. Although this model prescribes manners in which the subject organization ought to treat its stakeholders, based on the discovered rankings, we use this model only to better understand how much influence over C4 its stakeholders have.

Because MCCDC is a part of the powerful JCIDS process, and serves as the deciding entity in the Marine Corps acquisition process, it holds a high level of power over C4, while C4 can only advise MCCDC on IT concerns. For this reason MCCDC holds only a moderate level of interest in C4.

Given its role as the executor of the Marine Corps acquisition process, and the owner of programs of record, MCSC, likewise, holds a high level of power over C4, since the subject organization must aid in implementing programs and systems whether they adhere to C4's strategy, or IT portfolio, or not. Because C4's role in this process can add value to the programs that eventually affect the FMF, MCSC holds a moderate level of interest in C4.

Because the FMF elements do not directly influence C4, it is not typical to say whether or not they hold high or low power over our subject. However, power in the SA is defined as the ability to add or detract from the subject organization's value, so in this respect, and based on the FFA, the MARFORs and COCOM Marine elements hold moderate power over C4. However, given C4's role in promulgating guidance to the

operating forces and its support of system and program implementation, the FMF has a high moderate level of interest in C4.

The COTS IT providers are the most powerful group of all in this analysis. They hold a high level of power over C4 because they can insert their systems wherever local commanders can implement them, and they have a low level of interest in C4, limited mostly to compliance policies that would be followed in any case.

Because the DoD operates its acquisition apparatus from a joint perspective, and the Marine Corps at large can feel the impact of the other DoD Services' procurement desires, the sister Services hold a moderate level of power over C4, with regard to exerting influence on its IT portfolio. C4's impact on the other Services is very low, however, given the number and power of the other seats at the table, and so the other Services hold a low level of interest in C4.

This brief SA established that the other organizations in C4's immediate environment hold a great deal of power over the subject, while C4 holds at most only a moderate ability to influence its fellows.

C.   CONGRUENCE MODEL DESCRIBING C4'S FUNCTION WITHIN THE MARINE CORPS ACQUISITION ENVIRONMENT

Now the analysis must transition to the Congruence Model to further the research's understanding of how well C4 relates within the acquisition environment. By identifying resources, processes, inputs and outputs, cultural issues, formal and informal structures, and other aspects of this part of the acquisition process, one is able to understand where to target needed changes.

1.   Identifying Symptoms

The recognizable problems arising from C4's position in the acquisition environment are that its input is not consumed or heeded by its fellow entities in the quantity or manner desired, and that what is ultimately acquired by the Marine Corps is misaligned from C4's intended IT portfolio. According to Scott Thomas (personal communication, January 2012) at C4, this is manifested by MCSC program managers being able to ignore C4 protests over differences in planning priorities.

2. Specifying Input

a. Environment

As indicated throughout this chapter, the environment consists not only of the Marine Corps entities concerned with deciding what to acquire (MCCDC) and how to acquire it (MCSC), but also with the end users in the MARFORs and the COCOMs who will implement these systems and programs. The environment, therefore, is the assessment-decision-acquisition-programming-execution portion of Marine Corps planning, and encompasses many powerful interests. The status of COTS IT providers and the other DoD Services as other stakeholders make this environment even more challenging for C4 to positively influence.

b. Resources

The three resources that are keys to influencing this environment are status, funding, and knowledge. Status in this case translates into rank, as higher rank carries practical power while also serving as a proxy for greater prestige afforded in the first place to one person or entity over another. As the commander of MCCDC is a lieutenant general, this gives that entity leverage over the subject, the commander of which is a brigadier general. The commander of MCSC is also a brigadier general, but this agency holds the power of funding, because any portfolio C4 wishes to have is really only a different perspective on the programs that MCSC funds and controls. The third major resource, knowledge, is any subject-matter expertise respected by decision-makers, and this is well diffused throughout the environment. Although C4 is the principal IT advisor of the Marine Corps, it does not hold a monopoly over related knowledge, and individuals with IT expertise are distributed throughout the acquisition environment, in the operating forces and in the private sector. This brief analysis shows that C4 does not have a corner on any of the three key resources in this environment.

c. History

Recent history shows an increased awareness on the part of both public- and private-sector organizational leaders of the need for IT requirements to be considered in strategic planning (Ross & Weill, 2002). This has led to an elevation of the CIO as a

top-tier decision-maker, in both the private sector as well as in the DoN and Marine Corps. However, as with CIOs in the private sector, the Director, C4 still lacks the power of execution that comes with control over programs.

3.   Identifying Output

a.   *System*

The output that C4 expects to produce is the direction of all activities related to communications and IT functions, per its mission statement. The acquisition of systems, the governance of infrastructure and the ITSG and CPIC, and the issuance of guidance to Marine Corps communications elements are examples of the processes and products used to exert influence. These activities would ideally translate into an IT portfolio over which the subject has complete control. In reality, C4's output of IT oversight and policy is accepted by its fellow entities more so than its full control, but without complete governance they are able to pick and choose which directives and policies to follow, rendering ineffectual C4's attempts to manage the Marine Corps' IT portfolio. This perspective is shown in the following quote:

> How do I integrate multiple programs of record, essentially something like a portfolio? If your acquisition command isn't paying any attention to that and they don't want you to spend the money, how are you going to integrate multiple portfolios into an enterprise solution? You can't. (R. Anderson, personal communication, January 2012)

b.   *Individual*

As with other organizations, members of C4 see their primary role as following the Director's guidance and directives to accomplish what is possible within the bounds set by policy and by the realities of the acquisition environment. Although members may understand that C4 could better influence the environment if its fellow entities were more constrained into heeding its guidance, they accept and work within the practical limits.

4.   Identifying Problems

a.   *Structural Issues*

C4's explicit mission of directing and supporting Marine Corps IT functions leads necessarily to the implied imperative of establishing and maintaining a portfolio of IT capabilities that supports Marine Corps operations. This goal conflicts with the way that acquisition decisions are actually made and executed in the Marine Corps and the DoD—through the CBA, and then funded and controlled through programs. Because C4 has no ultimate control over these functions, it finds itself holding a weak position in the structure. "If you want to affect strategy, you have to affect acquisition. But within the ITSG, we're not affecting acquisition" (R. Anderson, personal communication, January 2012). This clash between the way C4 attempts to influence the environment and the way the acquisition process actually operates can lead to gaps in the Marine Corps IT portfolio, which could lower readiness and combat effectiveness due to poor information flow and processing (R. Anderson, personal communication, January 2012).

b.   *People Issues*

Although individual personalities can impact decisions and the relationships between the acquisition environment's entities, the underlying problems of the environment are likely structural in nature versus personality driven. Members of C4 will continue to attempt to influence the environment in C4's favor, but may gain little traction until structural factors are addressed.

c.   *Politics and Culture*

Given the distribution of resources, discussed earlier, within the acquisition environment, the political engagements among its entities tend to favor MCCDC and MCSC over C4 due to higher rank or funding. The impact of Marine Corps culture similarly hurts C4's position, as it prescribes that Marines be aggressive and seek maximum freedom of action. In the case of the acquisition environment, this means that C4's fellow entities will pursue their own self-interests, and if these do not coincide with C4's policies, or if C4 cannot force its fellows to adhere to its guidance, then they will

necessarily act counter to C4's wishes. Doing so will negatively alter the Marine Corps IT portfolio, according to C4.

5. Describing Organizational Components

a. Work

Although C4's mission describes its intended work, in light of the reality of its position within the acquisition environment, it must modify its tasks to remain influential. Because it has no ultimate control over the end product of the Marine Corps acquisition process, C4 must accept that this position changes its role from directing and governing all IT aspects within the environment to facilitating and executing decisions that have already been made, whether they align with its intended portfolio or not.

b. Formal System

The Director, C4 serves at the CMC's advisor and governor on all IT matters, and provides policy and oversight on all Marine Corps IT capabilities. C4 is composed of all the subsections needed to complete these tasks, including those responsible for data network communications, information assurance, radio communications, cyber security, and so forth. These subject-matter experts make liaisons with interested parties in all of the other organizations within the environment.

c. Informal System

Because the reality of the acquisition environment constrains C4 in the pursuit of its mission, C4's sub-sections shift from complete direction and governance of IT matters within the Marine Corps to support of decisions made elsewhere within the environment. Because of the decision power held by MCCDC through its role in the JCIDS process, and the execution power held by MCSC through its program authority, C4 must accept its traditional advisory and facilitating role to remain influential within the system.

6. **Assessing Congruence**

   a.   *Work*

   Some tasks that are part of C4's stated mission, such as governance and direction, cannot be entirely completed by C4 due to the lack of power caused by a lack of programming authority.   This means that the system output is incongruent because it differs from the intended, stated output, which is one where C4 has effective control over its IT portfolio through governance and policy-making, which influence its fellow entities.

   b.   *Formal versus Informal Systems*

   Although C4 is still effective at most of its tasks, and is respected as a source of subject-matter expertise and guidance, the notable transfer of processes from the formal system to the informal system is evidence of great incongruence.   Although the formal system still retains many of its functions, the authoritative governance that is expected from C4 instead transfers to the informal system, in the form of support for decisions made outside the organization.   This emphasis on contingent functions exhibited by the subject is evidence of the marginalization of its mission.

7. **Problem Hypothesis**

   The researchers theorize that C4's lack of authoritative influence in the acquisition process is due to its lack of programming control.   Because IT capabilities exist only as components of larger programs of record, and these programs are owned outside the subject, C4 ultimately has no control over its IT portfolio.   This fact flies in the face of its mission, which charges it with carrying out such authoritative actions as direction, governance, and policy of the Marine Corps IT infrastructure.

D.   **CASE STUDY ON HQMC INTELLIGENCE DEPARTMENT**

   1. **Limits of Quantifying Decision-Makers' Preferences**

   From Chapter III, the last portion this analysis was intended to be a proposed methodology for C4 to implement QDMP into C4's annual portfolio management processes: the ITSG and CPIC.   However, upon visiting three of the commands and

meeting with members of all four of the commands (C4, P&R, MCDDC, and MCSC), the researchers discovered that a tool that offers QDMP would be futile until the overarching structure is realigned to foster a better integration of work functions between these four commands.

Both the SA and the Congruence Model support the contention that C4 does not have a position that allows it to conduct the ITSG and CPIC in a manner that influences the entire IT portfolio management process. Therefore, a QDMP tool, as proposed in Chapter III, needs to follow the development process that integrates the workflow of all four major stakeholders.

2. Director of Intelligence's Enterprise Architecture Roadmap

The case study at the beginning of this chapter demonstrates how the DoN CIO, a higher echelon organization, has been able to incorporate all of the major stakeholders into its annual and periodic IT acquisition and portfolio management process. Although this knowledge is important, one must note that at such a level, the DoN CIO has comparatively much more power and influence upon the process than C4 has upon its processes of interest and relative commands. Therefore, in order to develop a comparative case study, the researchers compared C4 against sister commands in the Marine Corps and discovered that a striking similarity exists between the C4 and Headquarters' Marine Corps, Intelligence Department (HQMC-I). Although the relationship is similar, the methodologies used by the two organizations are quite different.

In a similar manner as C4's MCIENT-S, the Director of Intelligence (DIRINT) of HQMC-I published the *Marine Corps Intelligence, Surveillance, and Reconnaissance Enterprise (MCISR-E) Roadmap* in April 2010 (Stewart, 2010a). As part of the In Commandant of the Marine Corps' Service Campaign Plan (MCSCP), the MARADMIN 284/10 (Stewart, 2010b) specifies that the "Roadmap provides the framework and service-level direction for continued development and sustainment of an all-source ISR [intelligence, surveillance, reconnaissance] enterprise to meet specified and implied tasks in the MCSCP."

One of the key focus areas of the Roadmap in MARADMIN 284/10 is to "serve to inform the Program Objective Memorandum and Expeditionary Force Development System process" (Stewart, 2010b). This directive specifies how clear guidance given by the CMC delegates the role of DIRINT in the processes of P&R, through the program objectives memorandum (POM) process, and MCDDC, through the EFDS, also known as the JCIDS process. Because its role is specified clearly in the directive, the DIRINT can play a more active role in the processes, which influences the acquisition and sustainment of ISR.

Stewart (2010a) specifies HQMC-I's role in the ISR acquisition process in the *Marine Corps Intelligence, Surveillance and Reconnaissance Enterprise Roadmap* as integrating all aspects of HQMC-I into the requirements process. Because this document is designated "For Official Use Only," this analysis of their procedures is intentionally brief. However, future researchers should note that unlike C4's CPIC and ITSG processes, HQMC-I specifies its ISR systems requirements in a format more useful to MCCDC's capabilities assessments.

In the RAND Corporation's extensive study, *Alert and Ready: An Organizational Design Assessment of Marine Corps Intelligence* (Paul et al., 2011), the RAND researchers note that this clear-cut guidance from the CMC has given the MCISR-E *Roadmap* the ability to set in motion the "integration of all Service ISR elements into a holistic system, networked across all echelons and functions" (Paul et al., 2011, p. 46). Therefore, HQMC-I is actively involved in the requirements, acquisition, fielding, and management of all USMC ISR systems.

Although HQMC-I's major involvement is in the requirements and acquisition process, and C4's is typically in the strategy and portfolio management process, both organizations incorporate enterprise architecture. However, the guidance that drives HQMC-I is typically through the JCIDS, PPBE, and defense acquisition system (DAS) regulations, and their role is determined by the CMC. In the case of C4, they must adhere to the same regulations as HQMC-I, while furthermore complying with the directives of the CCA and CIO functions determined by the DoN CIO and CMC.

V. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY OF RESEARCH

1. Topical Research and Literature Review

This research reviewed IT governance research and literature including: portfolio management and ROI, the DoD acquisition process, cost-based analysis procedures and best practices, and, finally, organizational behavior theory and strategic management. Although the majority of this research was qualitative in nature, the researchers sought to bring into the discussion quantitative tools such as the principles of QDMP in the multiple-objective decision-making process.

2. Qualitative Analysis and Site Visit

The second stage of this analysis was an onsite visit to the Pentagon in which the researchers conducted interviews at Headquarters Marine Corps, C4. The researchers met with Mr. David Greene, a senior civilian leader, as well as subject-matter experts consisting of Marine officers and General Schedule employees who conducted the work behind the *MCIENT-S*, MCEN, ITSG, and CPIC processes. These interviews provided the basis for the SA and Congruence Model conducted in this analysis.

During this same trip, the researchers also met with Marine officers who work at Headquarters Marine Corps (P&R) in the Pentagon, and visited Marine Corps Base Quantico, VA, to meet with representatives of MCCDC and MCSC. The researchers interviewed all of these officers for their subject-matter expertise on their organization's role in the Marine Corps IT procurement and portfolio management process. These interviews also provided the basis for the external relationship (in regards to C4) portion of the SA.

B. CONCLUSIONS

Through the SA and Congruence Model, we conclude that in its current state, C4 does not stand in a position to effectively govern the Marine Corps IT portfolio management process. This may be because the guidance and directives governing DoD

acquisition regulations allow three additional stakeholders to directly impact the process (e.g., P&R, MCCDC, and MCSC). C4's role as the Marine Corps' CIO appears to have a less direct impact on the management process.

Although the CCA and DoD/DoN CIO guidance gives C4 the responsibility in the IT procurement and life-cycle management process, the authority lies in the funding. Meanwhile the funding is tied to the PPBE process and managed by P&R through the acquisition process, not the CIO directives. As long as C4 remains an outsider in the acquisition process, its CIO functions will not be relevant in relation to the Marine Corps' IT portfolio management process.

C. RECOMMENDATIONS

1. Recommendations for HQMC-C4

The primary recommendation from this research is for the Marine Corps leadership is to develop a systematic process to link the MCIENT-S and its two primary ROI processes, CPIC, and ITSG, to the MCCDC requirements-based CBA process.

In the *Marine Corps Information Enterprise Strategy: Implementation Planning Guidance* (*MCIENT-S: IPG*), a document published by the Director of C4 on April 2012, C4 apparently makes similar assumptions regarding the ITSG and CPIC in its direction and tasks to the CIO section of C4. The *MCIENT-S: IPG* states the following regarding the ITSG and CPIC:

> CIO—Employ the ITSG to execute good governance of IT enabling capabilities, enhance portfolio management discipline, and facilitate informed decision making on policy, processes, procedures, and resources required to govern the USMC IT Portfolio . . . CIO—Execute relevant Capital Planning and Investment Control (CPIC) process to leverage the ITSG, participating in providing input into Planning, Programming, Budgeting , and Execution (PPB&E) process, integrating with the force development process and documenting how IT resources are budget driven. (Nally, 2012, p. 7–8)

The tasks in the quote make two clear inferences that concur with the Congruence Model analysis. The first is that the ITSG does currently provide the means for C4 to govern the entire Marine Corps IT portfolio. Secondly, the CPIC in its current state is not

relevant in providing C4 an effective means to integrate with P&R's PPBE process and MCDDC's EFDS/JCIDS process.

Therefore, the researchers' recommendation to C4 is to conduct an analysis to compare the documents that go into and are produced in its ITSG and CPIC processes and then align those results with the data necessary to feed the annual PPBE process and the event-driven EFDS/JCIDS (CBA) process. The manner in which C4 can do this is to have its subject-matter experts (the FAMs) conduct QDMP on their level with their counterparts, such as the IPTs, at P&R, MCCDC, and MCSC. This mid-level effort on the parts of C4 and its FAMs can help link the ITSG and CPIC to the PPBE and CBA process and, thereby, make C4's input more meaningful to its sister organization in the acquisition process.

2.   Organizational Structure Recommendations

The FFA makes a recommendation for the broader structural areas that relate to the actual organizational architecture of IT portfolio management. In its current state, C4 may not be correctly positioned to meet the requirements of its CIO functions, because as the FFA demonstrates, C4 is not currently positioned as a "supplier" of information and ideas. As found in the FFA, the more that entities are positioned to the right in the model, the less influence they have on the process and their input may only add value rather than drive the process. Therefore, the researchers recommend that C4 take the necessary steps with its higher echelon to effectively switch around the Five Forces so that it becomes a supplier of information, ideas, and directional guidance in the IT portfolio management process. In doing so, the end product for the users in the field will better reflect what C4 directs, because entities like MCCDC and MCSC will only add value to C4's ideas, rather than originating programs that conflict with C4's notion of the Marine Corps IT portfolio.

There are two possible ways in which C4 can become a supplier in the Five Forces. The first is through clear-cut, directive guidance from the CMC. Because the CMC has already appointed the Director of C4 as the CIO of the Marine Corps and the executive agent responsible for the Marine Corps IT architecture, this should not be difficult. In a manner similar to DIRINT and the *MCISR-E Roadmap*, the Director of C4

could have MCIENT-S either signed by the CMC or published in the CMC's MCSP. If the Director of C4 can better demonstrate that he speaks on behalf of the CMC in all matters pertaining to IT portfolio management, this will give weight to his guidance across the Marine Corps that he speaks as the CMC's CIO.

The other recommended methodology is to conduct a higher level structural alignment of the documentation mentioned in the first recommendation to C4. Rather than realigning the mid-level entities' documentation, a higher level organizational realignment can look not only at C4, but P&R, MCDDC, and MCSC. All stakeholders' processes can be analyzed to determine how and where their workflows can be realigned for better integration.

3.   Future Research Opportunities

Because this analysis took a very broad, high-level perspective of the processes involved in the Marine Corps' IT portfolio management process, future researchers could easily examine any of the subject areas in more detail to conduct a deeper analysis. However, the researchers recommend following this research in two broad areas.

a.   *Quantitative Research*

Using the principles of cost-based analysis and/or cost effectiveness, compare and contrast the mathematical models currently used to manage the Marine Corps' IT Portfolio, such as comparing the linear optimization tool used by P&R's Program Assessment and Evaluation (PA&E) branch against the earned value management tools used by MCSC's Cost and Analysis Division. Furthermore, once the MCIENT-S is fully implemented, implement the tools of QDMP laid out in Chapter III in order to develop a methodology for C4 to utilize in their ITSG and CPIC processes.

b.   *Qualitative Research*

The major limitation of this SA was that it was conducted primarily from the perspective of C4. A future researcher could conduct a similar analysis from the other stakeholders' perspectives, primarily MCCDC and MCSC, and, thereby, compare and contrast the results for a holistic approach. Therefore, with the distinctions clearly

addressed, a methodology could be proposed for a better Marine Corps-wide IT portfolio management process.

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